

The Chemical Age

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NOTICES.—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

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The Leeds Meeting

THIS year's meeting of the Society of Chemical Industry at Leeds was an undoubted success. In the first place, the annual report of the Council shows an improvement not only in membership but in the financial position; and, although there was still a considerable deficit on the year's workings, if the treasurer can persist in such drastic economies as appear to have been effected during the past twelve months, the Society's accounts should show a balance on the right side when the next annual meeting comes round. Those who have enjoyed the hospitality of Yorkshire will need no assurance that the arrangements made for the Society's visit were admirable in every way; while unique opportunities were offered to visit chemical works, as well as to see something of Leeds University. The only criticism of a week of many attractions was that more time was not assigned both to the reading and to the discussion of the technical papers, which covered so much of interest to the theoretical as well as to the industrial chemist that it was quite impossible to appreciate them in the short time available. We suggest that at future meetings some of the evenings might profitably be devoted to technical matters, for it is not often that chemists from all parts of the country have opportunity to exchange their views.

Co-operation between science and industry was the key-note of more than one of Mr. Woolcock's speeches, and this year's meeting, held as it was in a city which is both the centre of a great industrial area and at the same time the seat of an important university, made that co-operation more possible in every way. Moreover, the fact that the joint meeting of the Institution of Chemical Engineers with the American Institute coincided with the Society's proceedings gave additional interest to them. At this meeting, Dr. Charles L. Reese presided and delivered his presidential address at a desk which was appropriately draped with the Union Jack and the Stars and Stripes. He pleaded for a closer working together between the English-speaking peoples, and this was supported by Sir Arthur Duckham in his address which followed. Technical papers were read by members of both institutions and the meeting was in every sense a tribute to this idea.

A close liaison between the scientists of industry and of commerce is not only essential to the progress of the chemical industry in this country; it is vital to the recovery of trade. Further understanding between Britain and America is one of the most hopeful developments in world peace since the war. This year's meeting at Leeds did a great deal to advance co-operation in both of these spheres.

Rivers and Road Tar Pollution

ON two occasions recently attention has been drawn in these columns to the report of the Standing Committee on Rivers Pollution, which seemed to favour the use of bitumen in preference to the use of tar for road treatment, and which has been widely accepted in that sense. We now learn from a trustworthy source that the River Pollution Committee of the Ministry of Agriculture and Fisheries is anxious to correct the impression that it is antagonistic to the use of tar in the preparation of road surfaces. The Committee, we are given to understand, is concerned solely with the question of the pollution of rivers from the standpoint of the fishery interest and, as it has been proved that the constituents of tar, if they find access to a river, are most injurious to fish and their food, the Committee earnestly advocates the avoidance of the use on any road, the washings from which are likely to find their way directly into a stream, of any road dressing containing tar or tar products. As it has also been proved that washings from bituminous surfaces are innocuous to fish and their food, the Committee has advocated the use on roads in proximity to streams of bituminous dressings. Obviously, the roads with which the Committee is concerned constitute only a small fraction of the total roads of the country.

We are authorised to say that it is no part of the Committee's policy either to advocate the general use of bitumen or to deprecate the use of tar or of any other particular material on road surfaces remote from streams, nor has it ever done so; but it considers it reasonable to urge upon all road authorities that care should be taken to avoid the use of tar at what are the danger points from the standpoint of pollution. The Committee also urges the Fishery Boards and other bodies charged with fishery interests throughout the country to draw the attention of the road authorities to those lengths of road upon which, owing to their proximity to streams, the use of tar ought to be avoided. The Committee is confident that it can rely upon the co-operation of the road authorities with the Fishery Boards in securing this measure of protection for fish and their food. The Committee has examined a number of preparations for road-surfacing and is prepared, if consulted by road authorities or other persons concerned, to advise them as to the suitability for use in proximity to streams of such preparations as they have examined.

Cupreous Pyrites

It is rather curious that in different countries throughout the world distinct problems arise in the disposal of sulphur-containing materials. In America, spent oxide is scarcely, if ever, used for the manufacture of sulphuric acid. Invariably, it is discarded as an uneconomic material, and sulphur or pyrites is employed. In this country, spent oxide and sulphur have displaced pyrites to a very large extent. This circumstance is undoubtedly due to two causes; the yield of sulphur per ton of coal carbonised has increased appreciably, and this has resulted in a substantial accession in the quantity of spent oxide available. On the other hand, the cost of recovering copper from cupreous pyrites cinders has sensibly advanced, but the copper companies have been unwilling to adjust the returning charges in proportion to the extra costs incurred, and many acid manufacturers who hitherto purchased cupreous pyrites exclusively and utilised the sulphur in the manufacture of vitriol, recovering the copper by the wet process, and selling the purple ore in the form of briquettes, have for some time now been compelled to have recourse to other forms of sulphur material in order to conduct operations profitably.

In some countries in the Far East pyrites abound, but there appears to be no adequate demand for the material. Indeed, we were asked the other day how increasing supplies of sulphuric acid could best be used. This question was raised because it was realised that if an additional outlet for sulphuric acid could be found, further quantities of pyrites could be treated, and the copper content, which is really the valuable constituent, taken advantage of. There is a limit to the disposal of chemical products which involve the use of sulphuric acid in their manufacture. Naturally one turns to chemical products such as ammonium sulphate and calcium superphosphate, which absorb approximately 100 per cent. and 50 per cent. of the weight of the resultant product. But obviously, it is futile to manufacture this product when there is already a surplus supply. What appears to be re-

quired in the Far East is a process by which sulphur dioxide could be reduced readily and cheaply to a commercially pure form of sulphur. This would then allow of the copper of the pyrites cinders being recovered by an electrical smelting process, or by the wet method of extraction, whichever was found to be the most suitable under the conditions obtaining. Sulphur dioxide can be reduced by hydrogen sulphide to a fairly pure form of sulphur, but we believe other methods were tried in Transylvania a decade ago, and found fairly successful. We do not know whether these methods are still in operation, but if any of our readers have knowledge of the process which we have in mind we feel sure that any information they can convey will be of peculiar interest. In any case, it is known that there is a demand for a process by which pyrites containing 45 per cent. of sulphur and 3 to 4 per cent. of copper can be utilised advantageously by methods other than those commonly adopted in this country.

Fire Damp in Metal Mines

SOME of our readers may recollect that in our issue of June 6, we drew attention to the presence of fire-damp in an old metalliferous mine which had been reported to us by Sir John Harrison, the Director of the Government Department of Science and Agriculture in British Guiana. It was remarked at the time that we had not come across any similar experiences and that possibly this particular instance was unique. We now hear, however, from Mr. D. A. Lyon, who is the acting director of one of the departments of the U.S.A. Bureau of Mines that fire-damp has also been encountered in some American metal mines, although the occurrence is, fortunately, rare.

In the reports that Mr. Lyon has sent us of the specific cases examined, attention is drawn to the fact that at one time there was a good deal of activity in re-opening long abandoned mines with the idea of extracting ores of a grade formerly rejected, but probably amenable to present day methods of treatment. Many of these properties have long been under water, and their re-opening is always likely to present the possibility of explosion. It will be remembered that Sir John Harrison attributed the presence of methane to the decomposition of old mine timbers, and while the American investigations bear out this theory in certain cases, it is interesting to note that the trouble may also arise from other sources. One can point, for instance, to certain gold mines where gas accumulation has been experienced and in which a carbonaceous slaty formation has been found, and it has been concluded that methane is evolved from certain carbonaceous rocks which are associated with mineral deposits, more particularly in California. While, therefore, there is no assurance that methane will always be encountered in de-watering or re-opening abandoned mines it would seem essential that every precaution should be taken when work of the kind is proceeding. The main provision appears to be that of ample air circulation which, as a general rule, can only be obtained by the use of mechanical ventilation equipment. It is worth while pointing out, too, that in their summary of recommendations the American investigators urge the use of electric lamps rather than those of the ordinary miners' type.

Treatment of Surplus Fish

AN article in a contemporary having reference to the conservation of ammonia in fish meal by drying it by indirect heat recalls the fact that prior to the war the treatment of fish offal and over-catches of fish was a very flourishing industry in this country. We remember that works existed at Brixham, Hull, Yarmouth, Leeds, Paisley, Birmingham, and many other towns. The fish was in many cases treated in an extractor of about five tons capacity, with a petroleum solvent, and oil was recovered. The fish meal remaining after the extraction process was invariably of excellent quality, and was shipped very largely to Hamburg as a poultry and pig food. A decade ago some manufacturers preferred to use a steaming process; others were emphatic in their declaration that the extraction method was preferable. Considerable attention was given to the design of the plant, with the object of reducing the loss of solvent to a minimum, and many manufacturers were able to operate with a loss of less than 0.75 per cent. Whether, since the armistice, developments have occurred in this country in plant for the treatment of fish offal it is impossible to say, but we understand that the California continuous process has been largely responsible for the rapid and successful growth of the industry in that country.

The Age of Synthesis

THE history of the organic chemical industry is characterised by a succession of events which, to a large extent, mark out its stages of development. They are the milestones along the road of progress. One by one the natural products have been superseded by those made in the factory. Nature is becoming less and less a competitor in the market of finished products. Unlike milestones, however, these triumphs of synthetic chemistry have not occurred in regular sequence. In the earlier days discoveries of outstanding significance, such as the production of artificial alizarin and indigo, were few and far between, but to-day we seem to be witnessing an almost continuous succession of successful attempts to obtain artificially those substances hitherto only derived direct from nature. Not many years ago perfumers were almost entirely dependent on plants as the source of their products, but to-day a large proportion of perfumes are wholly synthetic. To be sure, nature supplies all the materials in the first place. Coal, petroleum, wood, and the fats yield almost the whole of the starting materials for the organic chemical industry, but here again we see these products being gradually supplanted by those made by direct synthetic methods. Take the case of phenol, for instance. We are no longer dependent on that contained in coal tar; the synthesis from benzene is now an established process. But what of benzene itself? With the tremendous call on coal-tar benzene as a motor fuel as well as its other vital uses, all of which promise to increase in the future, it does not need very much imagination to visualise a synthetic benzene.

Acetic acid, for half a century the virtual monopoly of the wood distillation industry, can to-day be produced commercially from acetylene, and now we have a truly synthetic process for methyl alcohol, another

compound hitherto produced solely by the wood distillers. The synthetic resin industry is comparatively new, but is well established, while synthetic tannins have come to stay. In neither of these cases, however, is there any claim to reproduce the natural products. That complete success has not attended the commercial synthesis of rubber, camphor, vanillin, and other natural products, has not been due to lack of endeavour. In some cases these achievements have been the result of competition and the attempt to break down monopolistic tendencies. In others it is the natural outcome of the desire to create and preserve a balance in production. In coal distillation there is an overproduction of naphthalene and in wood distillation an excess of charcoal. So long as our present methods of dealing with natural products persist we are likely to see progressive development in the synthesis of compounds, and it is only a matter of time before such things as artificial turpentine, shellac, rose otto, glycerol, and so on, are added to the list.

Points from Our News Pages

"The Chemo-Therapy of Organic Arsenic Compounds," by Dr. G. Malcolm Dyson (p. 84).

Professor H. E. Armstrong, writing on the lessons of benzene, deplors the type of chemist that the schools and universities are producing as totally inadequate, and modern research, he says, "is carried on on lines which more than border on the farcical" (p. 89).

An appeal for a Science Party in the House of Commons in the interests of scientific progress is made by Mr. W. P. Dreaper, F.I.C. (p. 96).

A page of pictures of personalities at the Leeds meetings (p. 90).

"Coking Practice" and "Smokeless Fuel" were the chief subjects of discussion at Leeds. American representatives in several cases made interesting comparisons with their methods, and Dr. C. L. Reese took a prominent part in the proceedings (pp. 92-100).

Mr. L. E. Westman deals with the latest developments in Canadian electro-chemical and metallurgical industries (p. 101), and on various pages will be found notes on colonial progress and latest chemical statistics.

Our London market shows trade, if anything, slightly more active, but prices are steady. Tar products are affected by the possible coal crisis (p. 110).

There has been little business in the Scottish market this week, owing to works' holidays (p. 113).

Book Received

PHASES OF MODERN SCIENCE. Published in connection with the Science Exhibit arranged by a Committee of the Royal Society in the Pavilion of H.M.'s Government at the British Empire Exhibition, 1925. London: A. and F. Denny, Ltd. Pp. 232, 3s. 6d.

The Calendar

1925 July 27	Royal Society of Arts: "The Mineral Resources of Northern Ontario." Professor W. A. Parks. 4.30 p.m.	John Street, Adelphi, London
Aug. 26 to Sept 2	British Association for the Advancement of Science.	Southampton.
Oct. 4	Société de Chimie Industrielle: Fifth Annual Congress	Paris
Oct. 23	Engineers' Club: Annual Dinner.	Savoy Hotel, London

The Chemotherapy of Organo-Arsenic Compounds

By Dr. G. Malcolm Dyson

EVER since the day in 1760 when L. C. Cadet de Gassicourt prepared the first organo-arsenic compound—cacodyl oxide, or "Cadet's fuming liquor," as it came to be called—chemists have shown great interest in this series of substances, of which many thousands have been prepared; and in spite of the fact that the technique of dealing with many of them is difficult, there has been built up from them, not merely a few, but many whole series of drugs which have proved no less a boon to medicine than was the original discovery of anaesthetics. The first to subject Cadet's fuming liquor to systematic and rigorous examination was Bunsen in 1837, who, after a brilliant research lasting over six years, came to the conclusion that the compound was derived from a "compound radicle." However, he unfortunately overlooked the fact that the compound contained oxygen, a fact which was realised by Berzelius, who recognised the compound as the oxide of the new radicle, which he christened cacodyl. Since this time compounds of trivalent and pentavalent arsenic with all kinds of organic residues have been prepared, certain of which it will be interesting to consider in detail.

There seems a general consensus of opinion that Ehrlich was the first to really develop the theoretical principles and fundamental conceptions of chemotherapy, so raising it to the level of a science. Three important phenomena of disease treatment had been attracting his attention, and led him to develop his receptor theory of chemotherapy. These were:—

(1) The disappearance of malaria parasites from the blood on the administration of quinine.

(2) The decrease in syphilitic symptoms with the use of mercury.

(3) The destruction of various trypanosomes and spirilla by the use of arsenic compounds.

Ehrlich proposed the theory that some chemical combination must take place between the drug and some specific chemical group in the parasite, thus either killing the parasite outright, or preventing it from functioning in an injurious manner. The groups so concerned he termed "receptor groupings," and the phenomena of parasite destruction brought about in this manner "parasitotropism." However, the difficulty that stands in the way of the use of many of the arsenic compounds, is that although they may be perfectly suitable with regard to parasitotropism, they exert, at the same time, an injurious effect on the human organism. This phenomena Ehrlich called "organotropism"; and it will be readily seen that the true value of a drug depends on the relative values of its parasitotropism and its organotropism.

The chemotherapeutic index (I), is a comparatively accurate method of stating this relation, and as such is receiving considerable attention in connection with the chemotherapy of drugs. It is given by the expression:—

$$I = \frac{\text{M.T.D.}}{\text{M.C.D.}}$$

where M.T.D. represents the maximum tolerated dose and M.C.D. the minimum dose to produce the desired curative results. Thus, for instance, a drug for which the value of I was eighty would be one-third more efficient than one whose chemotherapeutic index was 60, and in practical use the margin of safety would be correspondingly greater.

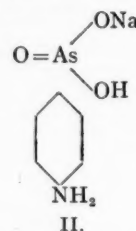
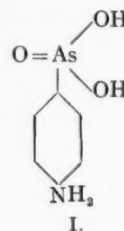
Rational Synthesis

In investigating the relation between the action of drugs, and the so-called receptor groups of Ehrlich, considerable trouble has arisen from the fact that the micro-organisms change in character with the application of the drugs; thus by treating an animal infected with trypanosomes with atoxyl, the parasites disappear for some time, but reappear later, and after several doses of the compound, an "atoxyl-fast" strain of trypanosomes is obtained, which do not lose their fastness to this particular drug for many thousands of generations. Furthermore, this strain is unaffected by many other arsenic preparations, from which we can deduce that the group which in the original strain of trypanosome combined with the arsenic (*i.e.*, the "arsenoceptor"), is in this atoxyl-fast strain, so modified that combination with the arsenic

cannot now take place. That the arsenoceptor and no other group is affected, is shown by the fact that the new trypanosomes are just as sensitive to the action of certain triphenylmethane dyes as they were in the older strain. Conversely it has been found possible to prepare a strain of trypanosome that is fast to the action of triphenylmethane compounds, but sensitive to the action of arsenic compounds.

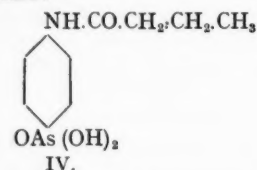
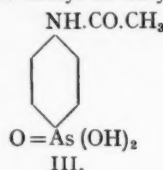
Obviously, then, the most vital problem in the chemotherapy of these receptor groupings is that of determining the relation that exists between the chemical constitution of the curative compounds and their pharmacological action on the receptor groups, since this will not only indicate the possible use of compounds already known, but also show the lines on which the synthesis of new and more effective compounds can be started, so that their synthesis can take a more rational course.

The chemical starting point of Ehrlich's work was the compound p-arsanilic acid or 4-aminophenyl arsonic acid (I.).

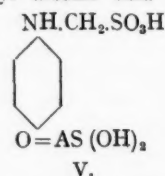


The sodium salt of this acid, known as "atoxyl" (II.) has been used medicinally, but has been superseded by more efficient remedies. The acid itself is prepared by heating aniline arsenate, when loss of water takes place, together with migration of the arsonic group to the para position—a reaction which is reminiscent of the preparation of sulphanilic acid. The acid crystallises in white needles, and has considerable spirillicidal and trypanocidal action, but its use in medicine is dangerous, since it induces nervous disorders and affects the optic nerve.

From para-arsanilic acid the acetyl and butyryl compounds were prepared by refluxing together the crystalline atoxyl with acetyl or butyryl chlorides:—

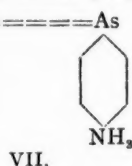


4-Acetylaminophenylarsonic acid (III.) is a compound with feebly basic properties, but the introduction of the acetyl group has had a profound effect on the toxicity of the compound, which is diminished to one-tenth of the power of that of the original amino-compound, while the spirillicidal properties remain almost unchanged. Its sodium salt has found considerable use under the name of "Arsacetin" in the curing of experimental trypanosomiasis. In the case of the normal butyryl derivative (IV.) both the toxicity and the therapeutic properties are much diminished. The same can be said of the introduction of the sulphonmethyl group giving 4-sulphonmethylaminophenyl arsonic acid (V.).

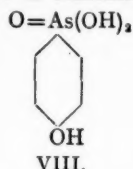


Continuing this work, he found that, although atoxyl and arsacetin were effective in the body even in small concentra-

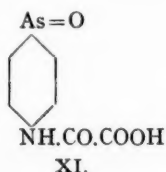
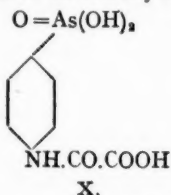
tions, they were all but useless in the test-tube for producing the same effects, even when employed in concentrations of 2 per cent.; from which he deduced the fact that the compounds must undergo some chemical change in the body. He assumed that this change was one of reduction, and by the attempt to accomplish this reduction outside the body, he obtained the compounds 4-aminophenyl arsine (VI.) and



4,4'-diaminoarsenobenzene (VII.), and was thus led to the discovery of the enormous spirillicidal activity of compounds containing the arseno group—As=As—. As an example of the efficacy of reduction in increasing the spirillicidal activity of arsenic compounds we may compare the activity of 4-hydroxyphenylarsonic acid (VIII.), which will not kill the parasites in concentrations of 1-2 per cent., with that of



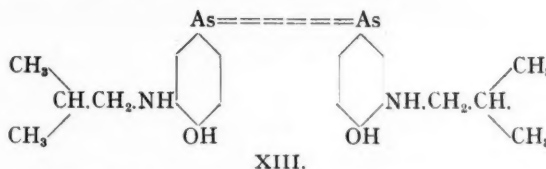
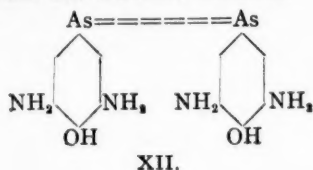
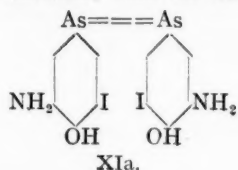
the corresponding arsine oxide (IX.), which will kill them *in vitro*, in dilutions of 1 in 10,000,000. A further case is that of 4-oxalylamino phenyl arsonic acid (X.), which has only one-fifth of the activity of the corresponding arsine oxide (XI.).



The Effect of Substituents

As would be expected, it is particularly difficult to predict the alteration in activity of an organo-arsenic compound, that will be produced by the substitution of groups into the aromatic nucleus. The general rule is, that if two groups, one of which is a salt-forming group, are already present in the aromatic nucleus, then the introduction of a third group usually increases the activity. This is true of the halogen, hydroxyl, alkoxyl or carboxyl groups, which are said to exert a eutherapeutic action. Exceptions to the rule are to be found in the introduction of methyl or amino groups, which in many cases decrease the activity—*i.e.*, they have a dis-therapeutic action. By experimenting with the substitution of various groups into arsenobenzene Ehrlich finally prepared 3,3'-diamino-4,4'-dihydroxyarsenobenzene ("Salvarsan" or "Arsphenamine") which is discussed in detail below.

An interesting case is that of the introduction of iodine into 3,3'-diamino-4,4'-dihydroxyarsenobenzene, when the compound (XIa) is obtained. In this the trypanocidal properties are completely lost, although the spirillicidal value is much enhanced. Again, he found that by introducing further amino groups into the arsenobenzene molecule the toxicity was raised, in contrary to the general rule in these cases, thus in the compound 3,5,3',5'-tetraamino-4,4'-dihydroxyarsenobenzene (XII.) the toxicity is 40 per cent. higher than that of salvarsan, while the therapeutic dose remained unaltered.

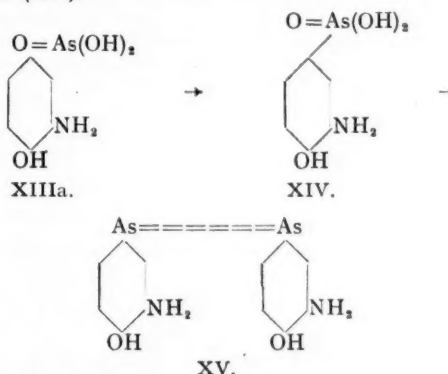


The effect of substituting the amino-groups of salvarsan, is to lower the activity. Thus in the case of the compound 3,3'-di-iso-butylamino-4,4'-dihydroxyarsenobenzene (XIII.) the therapeutic action is considerably lowered.

Salvarsan

This compound is recognised as the most important and valuable remedy for syphilis, so that some account of its manufacture on a commercial scale may not be out of place.

The reactions which lead to the synthesis of salvarsan, start from para-oxyphenylarsonic acid (XIIIa.), which is nitrated to give 3-nitro-4-oxyphenylarsonic acid (XIV.), which substance is then reduced by sodium hydrosulphite to salvarsan (XV.).



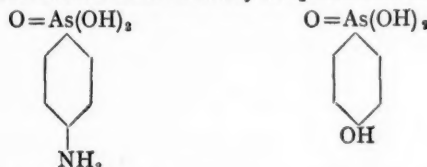
I.—Preparation of para-oxyphenylarsonic acid.

This can be done in one of three methods:—

- The condensation of phenol and arsenic acid.
- The diazotisation of arsanilic acid.
- Bart's reaction on parachloraniline, followed by digestion with alkali.

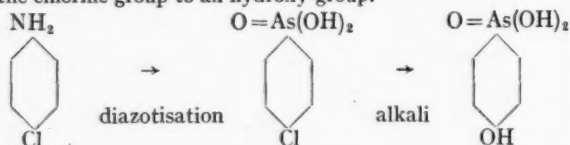
In the first process phenol (1 pt.) is mixed with crystallised arsenic acid (1½ pts.) and heated with continuous stirring for four hours at 150° C. The melt, which is by this time quite dark, is extracted with four times its weight of water, and the filtered solution evaporated *in vacuo*, after which the phenylarsonic acid is removed from the residue by warming with acetone, which is then removed by distillation. The crude acid remains as an oil, which solidifies and can be purified by means of the barium salt. It is dissolved in warm water, filtered from tar, and treated with baryta until the solution turns pink. The solution is then made just alkaline by the addition of caustic soda solution, filtered, and the barium precipitated with sodium sulphate. The clear solution is concentrated to a syrup and acidified with sulphuric acid, when certain impurities separate out. The solution is filtered from these, again neutralised, and evaporated to dryness *in vacuo*. The pure acid is then extracted from the residue with alcohol. The yield by this process is about 20 per cent.

The second method, that of diazotisation of para-arsanilic acid, is conducted in the usual way in aqueous solution, thus:—



while the preparation from para-chloraniline by Bart's reaction, consists in running a solution of diazotised chloraniline into a hot, strong solution of sodium arsenite, when the diazo-group is replaced by the arsonic acid group. Digestion

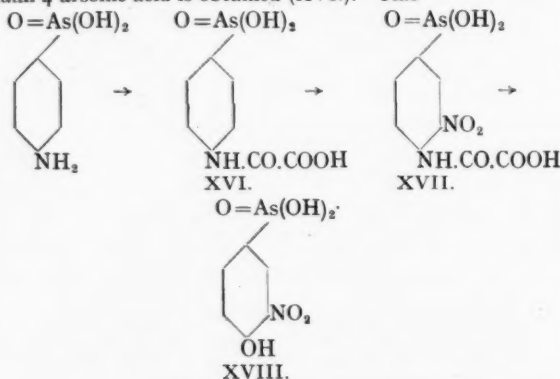
with concentrated alkali solution is then sufficient to convert the chlorine group to an hydroxy-group.



II.—Nitration of para-oxyphenylarsonic acid.

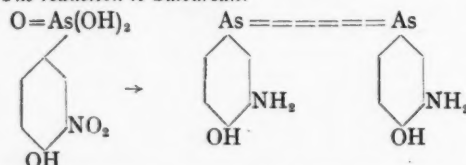
The compound 3-nitro-4-oxyphenylarsonic acid, which is the next stage in the preparation of salvarsan, is usually made by the direct nitration of para-oxyphenylarsonic acid. The latter is dissolved in concentrated sulphuric acid and the solution cooled to zero. The theoretical amount of nitric acid, dissolved in its own volume of concentrated sulphuric acid, is then run in slowly, and with continual stirring, at such a rate that the temperature does not rise above 0° C. After some time the mixture is allowed to warm up to room temperature, after which it is poured onto ice, and the nitro-compound filtered off.

Owing to the difficulty of obtaining a good yield of the para-oxyphenylarsonic acid, the nitro compound has sometimes been obtained by indirect means from para-arsanilic acid. This compound is heated with rather more than its own weight of crystallised oxalic acid, when the compound oxanil-4-arsonic acid is obtained (XVI.). This



compound is obtained in almost quantitative yield. It is then dissolved in concentrated sulphuric acid, and nitrated in exactly the same way as with phenylarsonic acid, save that in the final stage the mixture is poured into water, instead of ice, and the mixture heated to boiling—in this way a clear solution is obtained, which on cooling gives the 3-nitro-4-oxyphenylarsonic acid in lemon-yellow needles (XVII.). This can then be converted into the hydroxy compound (XVIII.).

III.—The reduction to Salvarsan.



In this reaction both the arsonic acid and amino groups are reduced by the aid of sodium hydrosulphite, in a faintly alkaline solution. Magnesium chloride together with sodium hydrosulphite are dissolved in water, and a solution of the crude nitro-compound in aqueous caustic soda solution is run in. The mixture is heated to 40° C. on a steambath and filtered from such impurities as may separate out at that temperature. The filtrate is then digested at 50–60° C. for a period of three hours, when the salvarsan separates as a yellow powder. It is filtered at 0° C. and subjected to immediate purification.

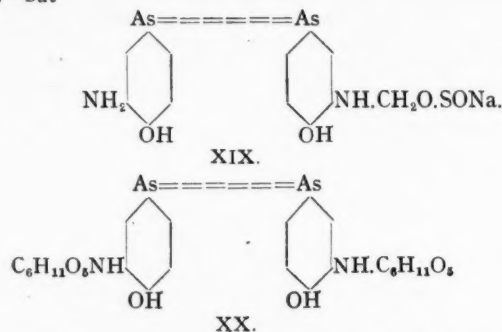
This purification can be done in several ways. The original method of Ehrlich was to dissolve the salvarsan in a solution of hydrogen chloride in methyl alcohol, and to add ether to the solution until the salvarsan dihydrochloride was precipitated. This was then washed with ether and dried in vacuo. It was preserved in an inert atmosphere. However,

the compound purified in this way was found to contain toxic impurities, and a more recent and satisfactory method of purification is to suspend the crude salvarsan in water, and to just dissolve it by the addition of twice normal sodium hydroxide solution. The solution is then filtered through a sterile "alundum" filter, to remove insoluble impurities, and the solution then neutralised with hydrochloric acid diluted with its own bulk of water. On pouring this liquid into a large bulk of hydrochloric acid of the same strength, the salvarsan dihydrochloride is precipitated as a yellow powder which can be filtered off and preserved in an inert atmosphere. About 25 per cent. of the crude salvarsan is lost in this purification. The reduction to salvarsan can also be performed electrolytically. The nitro compound is dissolved in potassium carbonate solution, and placed in the cathode cell. The anode cell is filled with a 20 per cent. solution of potassium carbonate, and carbon dioxide is passed through the cell throughout electrolysis. A current of from 15–25 amps. per 100 sq. cm. is passed between lead electrodes. The salvarsan separates out during the course of the electrolysis.

Therapeutic Action

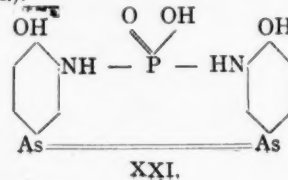
The action of salvarsan *in vitro* is weak, and it is assumed that some chemical change must happen to it in the organism before action takes place. In addition to the spirillicidal action of salvarsan, the compound exerts a tonic action and a feeling of improved health sets in after its use. Its toxicity is, however, very variable, and chemical examination alone of the compound after manufacture, is of little use as a guide to its freedom from toxic activity. The methods resorted to for ensuring that all commercial salvarsan is safe for use, are biological in nature, and all batches are finally tested and passed for use according to standards laid down by the Government Director of Biological Standards.

The therapeutic activity of salvarsan is efficacious not only against syphilis, but has also been found beneficial in many other spirochaetal diseases such as yaws, frambœsia, etc. However, the undoubted success which has been achieved in such diseases by salvarsan, has not attained the completeness hoped for, chiefly owing to inherent disabilities of the compound itself. In the first place it has to be dissolved and neutralised in an exactly measured quantity of caustic soda solution, and secondly, its solution is difficult to sterilise. To overcome this difficulty the salvarsan base was combined with sodium formaldehyde sulphinite (Rongalite) in "Neosalvarsan" (XIX.)—but

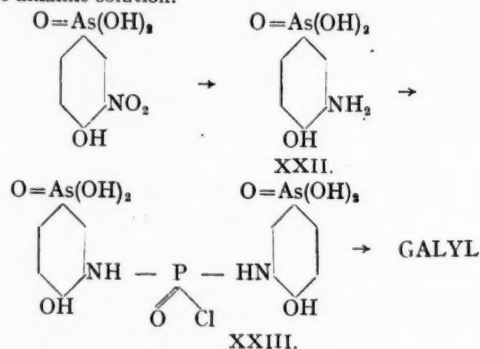


although this compound requires no neutralisation before use, it is comparatively unstable in solution. The problem has been recently solved by the use of the compound Stabilarsan, obtained by reacting salvarsan with glucose (XX.). This substance, which is readily soluble in water, requires no neutralisation before use, and is stable in solution, thus offering considerable advantages over the original preparation.

Another recent compound, which shares these advantages, is 4-4'-dihydroxyarsenobenzene-3,3'-phosphamic acid or "Galyi" (XXI.).



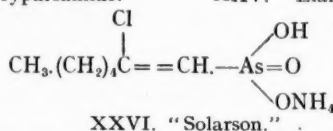
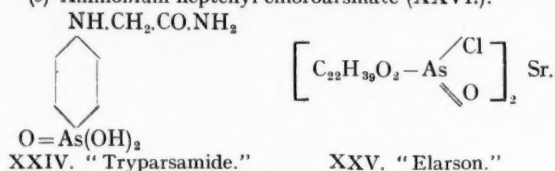
This compound is prepared from 3-nitro-4-oxyphenyl arsonic acid, which is electrolytically reduced to the half-way stage to salvarsan, 3-amino-4-oxyphenylarsonic acid (XXII.), in dilute alkaline solution.



This compound is treated with phosphorus oxychloride to give the compound XXIII., which is then reduced to Galy with sodium hydrosulphite as in the case of salvarsan.

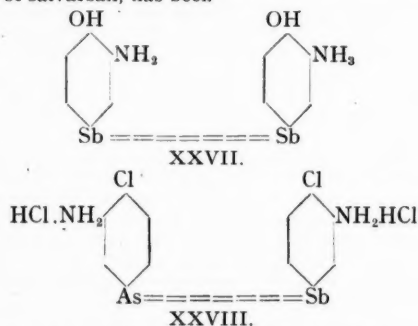
Among the other compounds that have been proposed for use as therapeutic agents we may mention three:—

- (a) N-phenylglycineamide-4-arsonic acid (XXIV.).
- (b) Strontium chloroarsinobenzenolate (XXV.).
- (c) Ammonium heptenyl chloroarsinate (XXVI.).



The use of these compounds is at the present time only in the experimental stage, and we must await further clinical results until they are accepted, or rejected, in general medical practice.

It may be added for the sake of comparison, that the corresponding antimony compounds have been prepared and shown to exert a spirillicidal action. Thus 3,3'-diamino-4,4'-dihydroxystibio-benzene (XXVII.), or the antimony analogue of salvarsan, has been



prepared, together with certain "stibarseno" compounds, such as 3,3'-diamino-4,4'-dichlorostibarsenobenzene dihydrochloride (XXVIII.). Their action is not so marked or important as that of the arsenic compounds.

Thus, in conclusion, it may be pointed out, that although the organo-arsenic compounds rank among them some of the most malodorous and poisonous substances known—substances which far exceed in virulence the "deadly" poisons of fiction—nevertheless, they also number in their company many substances which are given to humanity as weapons with which to subjugate some of the worst diseases known to the human race.

Coke Breeze Utilisation

The Advantages of Mechanical Flue Cleaning

IN connection with the use of coke breeze as a fuel for steam raising there is a certain amount of dust deposited in the flues, which applies in fact more or less to all refuse fuels in a fairly fine state of division. Under ordinary circumstances this would have to be endured because of the great economies obtained by the use of coke breeze and other fuels, either alone or blended with good coal. There is, however, no need for this trouble since the flues can be kept in a permanently clean condition without any difficulty by means of the "Vulcan" mechanical flue cleaner, already described in these columns. Typical of the experience of many different users is that of Mr. Charles Fairweather, Engineer and Manager of the Riverbank Gas Works of the Kilmarnock Corporation Gas Department. In this case the boiler plant consists of two "Lancashire" boilers 28 ft. by 8 ft., with feed water economiser, burning a large amount of coke breeze and coke dust, and the trouble with dust was so bad that every fortnight it was necessary to clean out the economiser flue and also the boiler side flues. It will be remembered that with ordinary coal every six months is generally regarded as sufficient, so that the difficult conditions of the job in question will be apparent.

Subsequently the "Vulcan" cleaner was installed, and this has cured the trouble entirely, the boiler attendants merely operating a steam valve for about two minutes each shift. Mr. Fairweather points out also that to have the flues in a continually clean condition in this way is of particular advantage to a gas works because steam is required constantly all the year round, and it is not possible to shut down the boiler plant completely at holiday seasons as with the ordinary industrial establishment.

Also another recent establishment at which the "Vulcan" cleaner is giving every satisfaction is the very well-known engineering works of Bellis and Morcom, Ltd., of Birmingham, and the principle should be of equal value in connection with all chemical plant fired by furnaces such as stills, evaporators, rotary driers, and roasters.

Atmospheric Pollution Research

THE Committee for the Investigation of Atmospheric Pollution was appointed by a conference of delegates of municipal authorities and others held in connection with the Smoke Abatement Exhibition in 1912. It has lately issued its report which covers the year ending March 31, 1924, the Committee thus completing the twelfth year of its activity. The primary objects of the Committee are the systematic measurement and analysis of atmospheric impurity and the collection of suitable data for the solution of various problems affecting the purity of the air.

Three sections of the report deal with the results obtained by what is known as the Standard Deposit Gauge, the principal function of which is to collect deposited impurity so as to compare the measurements of the amounts which fall in different localities, the Automatic Filter, which measures hourly the amount of impurity suspended in the air, and the Jet Dust Counter, which allows a microscopic examination of dust particles and their number to be made. The remaining sections deal with aspects of the work, including researches on the visibility of distant objects as affected by atmospheric pollution and spectrographic analysis of suspended impurities in the latter class, the discussion of the darkness of Wednesday, January 23, 1924, and of the distribution of dust in the vertical, based on observations by Dr. Kimball, of the United States Weather Bureau.

The report states that the air was not as pure as in the previous year. At Blackburn and Stoke-on-Trent the diurnal distribution of atmospheric pollution is broadly similar to that found in other cities, with a maximum in the forenoon. An important peculiarity of the Blackburn curves is the rapid rise of impurity which commences about 4 a.m. in the summer and reaches its maximum on week-days and Saturdays at 7 a.m., while on Sundays the maximum is not reached until 10 a.m. A description is given of a new instrument, the Settlement Dust Counter, designed by Dr. Owens, for measuring the amount of dust particles or bacteria in the air, even when such dust particles are very coarse, as in grain warehouses and similar places.

Chemistry and the Cotton Industry

Research on Oxidation and Light Problems

A PAPER on chemical problems in the cotton industry was given at the First International Conference of Women in Science, Industry, and Commerce, held at Wembley last week, by Miss Isabel M. Hadfield, M.Sc., of the National Physical Laboratory.

Dr. Barr and the author had investigated the possibility of traces of acid having a significant effect on the tensile strength of the fabric after storing, although the amount of acid was too small to be detected by the specification laid down by the British Engineering Standards Association.

With regard to the effect of mild oxidation on cotton, the author stated that as early as 1883 Witz recognised that oxidising agents had a marked effect on the properties of cotton. Much work had been done in subsequent years on what had been termed "oxycellulose," which had, however, not proved to be a definite chemical compound, but more in the nature of a mixture of decomposition products and cellulose. Two types of oxycellulose had been recognised; one was characterised by its reducing power, which was destroyed by treatment with caustic alkali, and the other by its affinity for basic dyes. The properties of the two types were summarised as follows:—

TYPE I (a) has power to reduce Fehling's solution or similar solutions of cupric compounds; (b) shows a brown stain when steamed in Harrison's solution, which is a mixture of caustic soda solution and silver nitrate in thiosulphate solution—this action is probably related to its reducing power; (c) loses weight when boiled in dilute alkali; (d) gives a yellow colour with cold caustic soda solution of 15 per cent. concentration.

TYPE II (a) shows an affinity for methylene blue and other basic dyes; (b) retains alkali, and hence has a high ash. Both types caused a lowering of viscosity in cuprammonium hydroxide solution, even though Type I had had a subsequent treatment with caustic alkali. Birtwell, Clibbens, and Ridge, in an extensive research on oxycellulose, produced during mild oxidation of cotton, used many of these properties to identify the nature of oxidation by different oxidising agents. The author quoted, however, only the change in copper number, methylene blue absorption, and viscosity in cuprammonium hydroxide solution, but any of the other characteristic properties of Types I and II could be substituted for copper number and methylene blue absorption.

It was obvious from results obtained that a measure of either the copper number or methylene blue absorption alone might not show correctly the amount or even the presence of oxidised cotton. Except when cotton was bleached in neutral solution within quite narrow limits of the neutral point, the presence of Type I or Type II gave no indication of the presence of the other. It was necessary, therefore, to use these tests in conjunction with one another, and even then it must be remembered that Type I could not be detected by a copper number after the material had been boiled with alkali. The lowering of viscosity in cuprammonium hydroxide solution, however, showed previous oxidising attack irrespective of the type of oxidation and subsequent alkali boil. The same authors had measured the lowering of viscosity of cottons of widely different copper numbers and methylene blue absorptions, and had found that, after the initial stage of oxidation corresponding with an oxygen consumption of less than 0.1 per cent., the viscosity varied with oxygen consumption whatever the nature of the oxidation. It should be noted, however, that acid attack and prolonged boiling with alkali also lowered the viscosity.

Sunlight Effect on Fabrics

The third problem dealt with was the action of light on cotton. The formation of oxycellulose appeared to be partly responsible for, if not the whole cause of, the tendering of fabric after exposure to sunlight for long periods. The author said that Dr. Barr and herself had found that an exposure of a few hours caused a significant change in the viscosity of the cotton in cuprammonium solution. The use of this method overcame one of the difficulties in work of this kind, as it reduced the period of exposure necessary to produce measurable tendering. The change of viscosity merely indicated modification of cellulose, but other evidence

made it probable that it was largely a question of oxidation. Dorée and Dyer, and Harrison, had found that the products, after exposing cotton and linen to the mercury arc, gave the characteristic reactions of oxycellulose. This, taken in conjunction with the evidence of Ramsbottom, that the deterioration of linen threads exposed to sunlight in a high vacuum was insignificant compared with that in the presence of air or oxygen, the latter having several times the effect of air, made an oxidation theory very probable. Much further work was necessary, however, before the action of light on fabric was really understood.

The British Association of Chemists

A Question of Patent Rights

THE question of the rights of the chemist-inventor is one that has not received much attention, but, nevertheless, it presents an interesting problem for consideration.

It is the general rule amongst employers that discoveries made by technicians in their employ are the unconditional property of those who employ them; and, unfair though this rule may appear to be on the face of it, there is something to be said for it. From the industrialist's point of view investigation appears as a very risky form of investment. In any case it appears to yield results slowly, and sometimes to yield no results at all. The industrialist therefore claims as his right the full fruits of a success that appears to be fraught with so much risk. It is argued that the technician's salary is paid, at least for a time, whether or no he obtains results, so that he cannot expect additional reward for a solitary success, however valuable to his employer that success may be.

The Technician's Viewpoint

In one important particular, however, this argument is unsound, for failure is not always the fault of the technologist. The lines of investigation are not infrequently mapped out for him by those with insufficient knowledge of the subject, so that he may begin a task which he knows to be hopeless. Another fruitful cause of failure is the unwillingness of the financier to allocate sufficient funds for a particular investigation. In such cases the technologist may, through no fault of his own, fail, or accomplish only a partial and costly success. For success, it is necessary to leave the matter from the very beginning almost entirely in the hands of the expert. This is admittedly to embark upon a type of risk which is distasteful to the business man, but against this it may be asserted that the technologist knows not only what to do, but what to avoid: and what to avoid is not the least important element in any scientific investigation.

A Sharing of Patent Rights

On the other hand, a share in patent rights would greatly encourage research, and would increase the industrial chemist's enthusiasm. In cases where the chemist is an employee, it is obviously unfair that patent rights should pass to him whole and entire, but the knowledge that an invention passes completely out of his hands does not tend to foster enthusiasm for research. Again, participation in patent rights would do much to eliminate those cases where technologists have worked in secret in their employer's time, and have subsequently obtained patent rights for some invention. It is true that the law provides for such cases, but it is by no means always possible to obtain sufficient evidence. Such acts cannot be too strongly condemned, but, though infrequent, they are unfortunately not unknown. It is through a lack of complete confidence that such irregularities arise, a lack of confidence that would cease to exist if the technologist were certain of a share in the success of any investigation he undertook.

Upon this point, however, the technologists themselves are sharply divided, some maintaining that they desire a share in patent right, while others hold that adequate—they do not ask for large—remuneration is all that they desire. In our view, the most important question is the principle involved; and if the chemist is offered a share, however small, in the fruits of an invention for which he may be largely or entirely responsible, his prestige and that of his profession is upheld. The Association is not prepared at present, however, to pronounce any official opinion upon so important a matter. It will welcome any suggestions that may facilitate the full ventilation of the matter at some future date.

H. T. F. R.

Benzene and its Lessons

The Dyestuff Industry and its Future

By Professor Henry E. Armstrong

THE celebration of the centenary of the discovery of Benzene by Faraday has been closely followed by the annual meeting of the Society of Chemical Industry, held this year at Leeds, at which the children of Benzene were happily taken by the President, Mr. W. J. U. Woolcock, as the topic of his address. Man of the world as he is, he could not well have appeared before the world with a more presentable, ornate, and (once) wealth-begetting family. Not long ago we heard of a funeral—was it not in Panama?—at which the deceased was followed to the grave by ninety children. Mr. Woolcock presented over nine hundred. They were clad, not merely in purple and fine linen, but in all the colours of the rainbow and many composite tones, applied to every kind of fabric. He attempted the impossible—to sketch their progress in life, begun not seventy years ago, and their future; impossible, not only because of their number, but because of the care with which the history of many of the more important has been hidden, when not lost. Still, he succeeded, to an extent which few could have accomplished, in painting a picture glowing with colour and also full of moral lessons.

All but a handful of the dyestuffs have been discovered since I began to study. I believe I am the senior chemist alive conversant with much of the inner history of the development of the fortunes of the Benzene family, having been acquainted, if not on terms of intimacy, with all the chief actors in the dyestuff drama. I therefore can claim some sense of colour perspective and aim, in a way, monarch of what I survey.

An Optimist—on Conditions

I dealt with the subject years ago, in my section of the Hofmann memorial lecture, published by the Chemical Society, as a declared pessimist; also in my presidential address to the same Society in 1894. In fact, to my sorrow, I was a confirmed pessimist, up to the war, in so far as the organic side of our science was concerned. It seemed to be outside the comprehension of the commercial mind. Then a change set in for which some of us had long been laying foundations. We proved to the world that chemistry *was* in our blood—that we were capable of the highest flights. While science had its way because it alone could construct and lead, great things were done, under pressure and under the direction of the few. Since the war we have fallen back—the narrow commercial spirit having once more regained the paddle. Government went out of its way to secure mismanagement—through lack of technical understanding. Gradually we are learning that ignorance must be deposed, but this still fights hard for supremacy—notwithstanding the brilliant examples against it in the Fat Industry, the Viscose Silk Industry, and the Nickel Industry.

Still, I am now optimistic where formerly I was a pessimist—but on conditions. I foresee the possibility of a fruitful marriage of science with industry and the downfall of the uninformed arrogant commercial spirit which contributes so much to our undoing—if all parties will play the game, my own especially. We cannot furnish the necessary leadership. We lost fearfully in the war. Afterwards, the great mistake was made of rushing students quickly through parrot university courses and turning them out—as if they were trained. Such a product is worthless—a danger—for practical purposes. Industry can use only a real and ripened receptive intelligence with advantage. It needs gentlemen in the truest sense of the word. A large number who are socially unfit, encouraged by scholarships given for knowledge without understanding, are taking to "science." There are "chemists" innumerable at demand—but scarce a chemist with the thought power, the working ability and dogged perseverance, the manners, moreover, that are needed in industry. The young man of to-day seems born tired of work, even on behalf of play: what soul he has goes into the motor-car. Too many of the teachers are hopelessly narrow and impractical in their outlook, nay, unscientific—without the morality of logic. Most arrant nonsense is being talked at the Chemical Society, issuing from Oxford and Cambridge, Leeds, Liverpool, and even Manchester,

so that the minds of young students are being poisoned by loose example and fallacious statement. Research is carried on on lines which more than border on the farcical, and is none the less used as blatant advertisement. Real subjects of study are neglected. We need to return to the honest, modest, and striving pedagogue of the past. The training formerly given so well in the German Universities, especially, the rigid discipline of laboratory practice, is lacking—even to the Germans. We shall only succeed by being honest. We, indeed, need to go back to famous men, to our fathers who begat us, and find an example in their work.

The Gospel of Work

Mr. Woolcock's brilliant survey is of great value in placing the conditions before us. To-day, as he shows, we are not merely in competition with Germany but with the world. The field is overfull of workers, and some of the combatants must go under. The tourney will be won by the exercise of intelligence, always with full honesty of purpose and disregard to self. To win by such means will be honourable. The Germans gained their success in no sordid way, but largely through the exercise of idealism. This must be the conclusion of all who can sense the pæan of victory which my late distinguished friend Caro sounded in Germany in the epic story of the progress of the dyestuff industry he told shortly after Hofmann's death, claiming that it was essentially a German prerogative. Let this be to us both an example and a warning. An we will, I am sure we can, do as well as the Germans ever did, but we must shed our modernism and get back from the unsubstantial hydrogen ion to real tangible acids, and putting up our slates, no longer play at oughts and crosses, but work.

The situation is one to be studied from all sides—not alone from the commercial and technical, but also from the academic and political.

"Our time is one for earnest deeds."

The schools furnish the workers, so we must begin with the schools of every grade. Their present product is a disgrace to our civilisation, to our intelligence. The University product is in no proper way trained to serve the community. So much is Benzene teaching us—may we heed the lesson without delay.

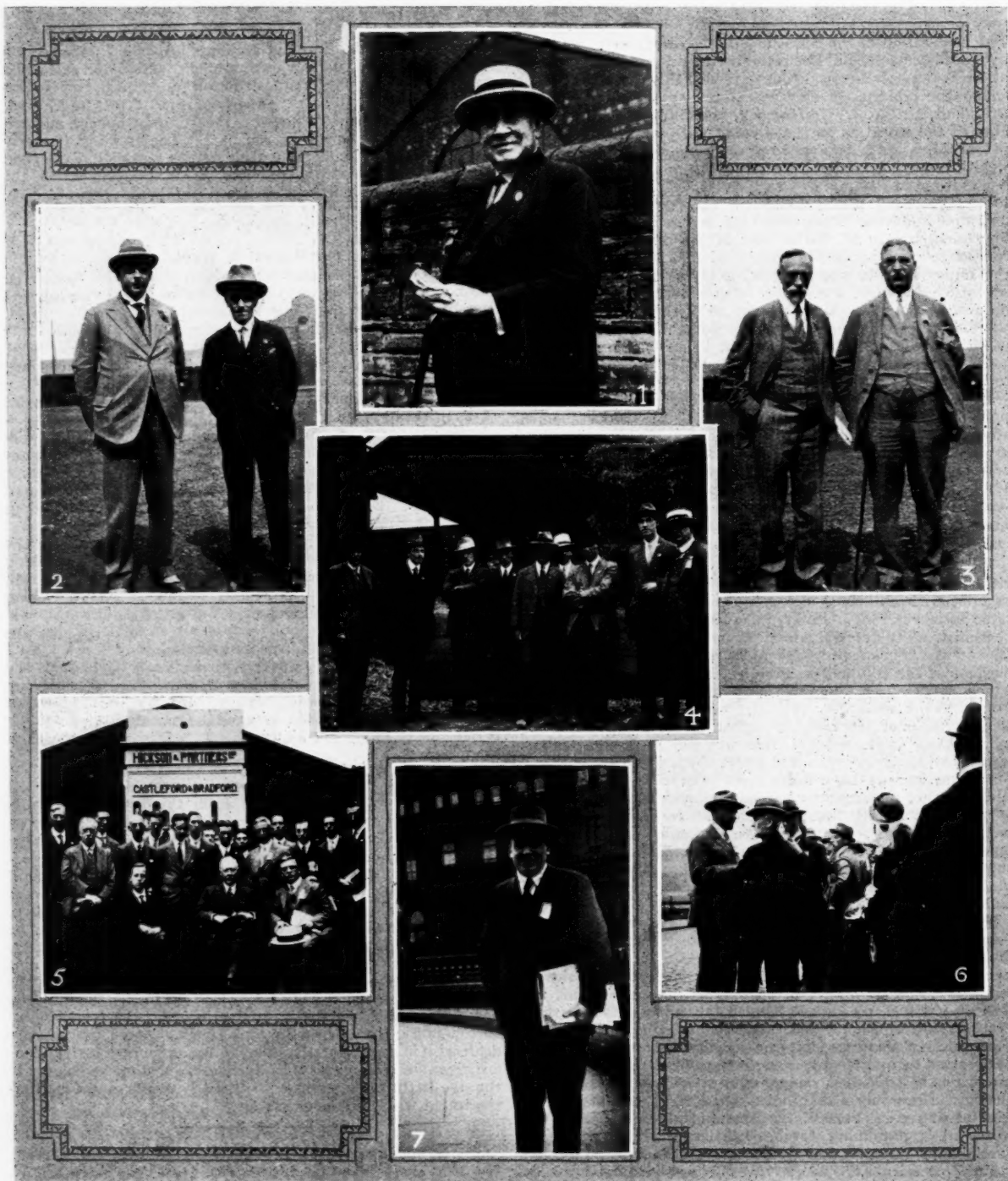
B.D.C. Thionol Colours

THE latest publication received from the British Dyestuffs Corporation is a pattern book of their Thionol Colours on cotton yarn. In the past B.D.C. sulphur colours have been supplied under the two names, "Thionol" and "Cross Dye," but it has been decided in future to use the name "Thionol" as the group name for these colours. The sulphur series includes 38 colours, and the 128 samples of dyed yarn here shown illustrate the remarkable variety of shades that may be obtained by the use of different strengths of one dye, by after-treatment with copper-bichrome, and by a mixture of different colours. Sulphur dyes present certain difficulties, such as the change in shade which may take place even after the material has been oxidised in the air and dried, and the tendering of cotton fabric dyed with Sulphur Black. These matters are dealt with in useful notes, and in addition practical instructions are given for dyeing, for the addition of substantive colours to the dye bath, for topping with basic dyestuffs, and for after-treatment with various chemicals.

Successful Swiss Dye Firms

HIGH dividends have been declared by the four Swiss aniline dye concerns. The Gesellschaft für Chemische Industrie has paid 15 per cent., with net earnings for 1924 of over 3½ million francs. The Sandoz concern has declared 25 per cent. and certain benefits, while the Geigy undertaking, although, being a private company, it does not issue a financial statement, is known to have had a successful year. The profits were approximately 3 million francs, or about 40 per cent. of the capital stock. Durand and Huguenin have declared a dividend of 10 per cent.

Some Snapshots at the Leeds Meeting



1. DR. ELLWOOD HENDRICK, OF NEW YORK. 2. DR. E. F. ARMSTRONG, GENERAL MANAGER OF THE BRITISH DYESTUFFS CORPORATION, WITH (RIGHT) MR. C. J. T. CRONSHAW AT HUDDERSFIELD WORKS. 3. DR. CHARLES REESE, PRESIDENT, AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, WITH (LEFT) MR. A. H. HOOKER. 4. GROUP AT LUMB'S GLASS BOTTLE WORKS, CASTLEFORD. 5. MR. ERNEST HICKSON (CENTRE), WITH (RIGHT) PROFESSOR J. W. HINCHLEY AND OTHERS, AT CASTLEFORD. 6. DR. CULLEN, DR. STEPHEN MIALI, ETC., WAITING FOR THE TRAM AT HUDDERSFIELD. 7. SIR ARTHUR DUCKHAM, K.C.B., PRESIDENT OF THE INSTITUTION OF CHEMICAL ENGINEERS.

Society of Chemical Industry at Leeds

Further Impressions of the Annual Meeting

We give below some further impressions and notes on the Annual Meeting of the Society of Chemical Industry which concluded at Leeds on Saturday, July 18, together with a page of photographs, and summaries of the papers presented at the various conferences.

At the present time the subject of coal carbonisation in its relation to the problems of the mines is of such interest that it was appropriate that the technical discussions of the Society of Chemical Industry this year should have been devoted to "Coking Practice" and "Smokeless Fuel." Professor J. W. Cobb, of the Coal and Gas Fuel Industries Department of Leeds University, presided at the first symposium, and of the papers contributed, that by Mr. C. P. Finn on "The Disposal of Coke Oven Gas for Public Supply" was especially concise. As manager of the Manvers Main Collieries Co.'s coke ovens, he combined theoretical with practical considerations, and evoked an interesting discussion, in which some of the American chemists took part. Dr. Lessing's paper on "The Influence of Ash Constituents on the Coking Process" was also greatly appreciated, though its length allowed of no discussion, and perhaps the only criticism of a week of many attractions was that more time could not be assigned for a full discussion of the technical papers.

The second symposium, on "Smokeless Fuel," was organised by the Chemical Engineering Group, and Sir Arthur Duckham took the chair. Interesting papers were presented by Dr. Margaret Fischenden, Mr. F. S. Sinnatt, and Mr. Edgar C. Evans; the latter emphasised the need for a standard sized coke, and said that if this could be achieved, at least one useful outcome would have resulted from the Conference. When this meeting was thrown open to discussion, so many members desired to express their views that it was decided to hold another session at a date to be fixed later, and probably to take place in the Midlands. An exhibit of coke fires, organised by Dr. E. W. Smith, was on view at the conclusion of the papers, and showed domestic fires making use of this fuel. While the papers were intended to cover the general principles of smokeless fuel practice, no mention was made of powdered fuels which are now being used in America. The early difficulties associated with their use appear to have been overcome by the electrical precipitation of the finely divided ash, which has rendered them entirely free from smoke.

From the standpoint of the chemist, certainly the most interesting technical paper presented at Leeds this year was on "The Tars and Oils obtained from Coal," by Messrs. F. S. Sinnatt and J. G. King. It was read in connection with smokeless fuel because, as Sir Arthur Duckham said in introducing the author, the subject is fundamental to a solution of this problem, but it is to be regretted that it had to be presented in a short period and at the end of the symposium. Many will also regret that the discussion of this paper had to be postponed, because it is improbable that all those who heard Mr. Sinnatt will be able to attend the further meeting which is to be held at a later date. In the course of the paper, reported in another column, an announcement was made of the results of the application of hydrogenation to coal obtained at the Fuel Research Station, and the subject aroused a great deal of interest. In connection with the Bergius process, with which this paper largely deals, it will be remembered that in some recent French chemical

notes (THE CHEMICAL AGE, Vol. XIII, p. 37) M. Kling's impressions of the Mannheim-Rheinau plant for the production of oil from coal were reported.

A luncheon held in the crypt of the Town Hall was given by the chairman and directors of the British Dyestuffs Corporation on July 16, prior to the Society's visit to its works at Huddersfield. In the course of the speeches on this occasion, Mr. Woolcock pointed out that the policy initiated by Dr. E. F. Armstrong, when he was president, had resulted in an increase in membership and in improvement of the Society's position generally, and he had displayed qualities which the Dyestuffs Corporation was to be congratulated in now having at its service. Col. Sir Edward Brotherton, in supporting the toast, said that there was every reason to be hopeful for the future of this concern, which ought to have the encouragement of everybody. In replying, Dr. Armstrong said that while the Corporation had been the subject of a great deal of comment in the past, it was always easier to criticise than to construct, but he felt confident in saying that the foundations had now been well and truly laid. He also wished to state that no director ever had a more loyal and enthusiastic body of men working with him than he had, and that such team-work should lead to the satisfactory results which everyone desired.

When the Society last met at Leeds, in 1895, the educational movements which were to give rise to the University in that city were beginning to mature. The School of Medicine had been established in 1831, and the Yorkshire College of Science had opened its doors in 1874. A local university extension committee formed at about the same time, under the parentage of Cambridge, then handed over its work and financial resources to the college which, thus endowed with the beginning of a faculty of arts, became incorporated in 1878 as "The Yorkshire College." The amalgamation of this with the School of Medicine took place several years later, and in 1904 the University of Leeds was created by Royal Charter. Last April it celebrated its twenty-first anniversary, and throughout the period of its existence the University has kept pace with the growing recognition of the importance of scientific research.

It was therefore fitting that the Vice-Chancellor should extend a welcome to the Society at its annual meeting, which was followed later by tea at a reception held in the great hall of the University. Some interesting exhibits were to be seen in the adjoining scientific laboratories, and in the department of colour chemistry some practical dyehouse machines were at work. Apparatus for fuel, refractory materials, and metallurgy were shown elsewhere, and the departments of textile and leather industries were also open to the visitors. The Pro-Vice-Chancellor of the University is Professor Cobb, who presided at one of the technical meetings, while as secretary of the Yorkshire Section, Professor N. M. Comber was largely responsible for the admirable arrangements of the week. The understanding between the scientists of commerce and of the university, which is essential to the

progress of the chemical industry in this country, was made more complete in every way by this year's meeting.

DR. CHARLES L. REESE, President of the American Institute of Chemical Engineers, is the leader of the party of American chemists now visiting this country. He was born in 1862, and after graduating from the University of Virginia, studied at Heidelberg under Bunsen and at Göttingen under Victor Meyer. In 1900 he was appointed chief chemist to the New Jersey Zinc Co. At this time, the contact process for sulphuric acid was in its infancy, but Dr. Reese developed the process until it was on a satisfactory working basis. His work there attracted

the attention of the Du Pont Co., of which he was appointed chief chemist in 1902 and later he established and organised the Eastern Laboratory with singular success.

Dr. Reese was afterwards appointed Director of the Chemical Department. In 1921 this Department of the Du Pont Co. consisted of five laboratories, and in addition to 400 research chemists, there is a large staff of chemical experts at the central office in Wilmington organising and correlating the work undertaken. This great organisation was built up under the direction of Dr. Reese, and in recognition of his most valuable services he was in 1917 elected a director.

Symposium on Modern Coking Practice

Papers Before the Leeds Conference

On Wednesday morning, July 15, a symposium on coking practice was held at the annual conference of the Society of Chemical Industry. Papers were contributed by Dr. R. Lessing, Mr. R. A. Mott, Mr. C. P. Finn, and Mr. W. H. Hoffert.

ON Wednesday morning, July 15, at the conference of the Society of Chemical Industry, a symposium on "Coking Practice" was held at the Philosophical Hall, Leeds, and the meeting was presided over by Professor J. W. Cobb (Department of Coal Gas and Fuel Industries, Leeds University).

Professor Cobb, in opening the meeting, said that it was now generally agreed that progress towards any properly worked out rational system of using fuel and of arriving, on the way, at smokeless cities, was bound to involve the process of carbonisation. The symposium was to consider one aspect of carbonisation, viz., the production of coke, and this served to illustrate the point that carbonisation could no longer be considered as one process. It was no longer permissible for the coke oven manager to think in terms of coke alone, nor could the gas manager think in terms of gas alone. The balance sheet must take into account all the products and the cost of their production.

Ash Constituents and the Coking Process

The first paper was by Dr. R. LESSING on "The Influence of Ash Constituents on the Coking Process." In this, he dealt with the way in which the ash forming constituents affected the carbonising process. The ash acted in the first instance as a diluting impurity. Assuming a 10 per cent. ash-content of coke, a dead weight of 1,275,000 tons was charged into British coke ovens per annum, requiring the equivalent of 1,200 ovens with corresponding losses in fuel economy, handling, and capital charges. The inherent ash in the coking constituents, which amounted to from 70 to 80 per cent. of the bulk of coal, was no more than 2 per cent. The greater part of the ash was distributed among the non-coking portions of the coal and the dirt. The ash reduced the coking power, and was largely responsible for the production of breeze. Ash in coke was detrimental to the blast furnace process by reason of the extra limestone required for fluxing silica and alumina, and of fuel for melting the slag formed. It thus reduced the available heat in the hearth, the strength of coke, and its reactivity.

The difficulties of studying the active influence of ash composition on the coking process lay in our inadequate knowledge of the mode of combination of the inorganic compounds in coal and the chemical changes they underwent during carbonisation. The conversion of acid-soluble alumina in coal ash into acid-insoluble aluminium silicate in coke ash was demonstrated by detailed analyses. The work on the catalytic influence of the mineral constituents, to which the author had given special attention for many years, has been confirmed by recent researches of Cobb and practical observations of Baehr, Koppers, and others. In work lately carried out, the author found that the addition of small amounts of inorganic compounds affects not only the yield of coke and other products in high and low-temperature carbonisation, but also the chemical composition of the coke. The results threw some light on the important question of the properties of coke in regard to reactivity, combustibility, inflammability, and general structure.

The Heating of Coke Ovens

Mr. R. A. MOTT, M.Sc., A.I.C., in a paper prepared with Mr. R. Wigginton, B.Sc., A.R.C.S., of the Department of Fuel Technology, Sheffield University, dealt with the problem of uniformity of heating throughout the length and height of an oven wall. Reference was made to the methods adopted in coke oven practice, e.g., in the "old" Otto, Koppers, Semet-Solvay, Coppée, and Simon-Carvés waste heat and regenerative types of ovens, for the distribution of the gas and air, when typical dimensions of the oven chamber were length 10 m. (32 ft. 10 in.), height 2.0 to 2.5 m. (6 ft. 7 in. to 8 ft. 1 in.), and a mean width 0.5 m. (19½ in.). The greater difficulties associated with the attainment of uniformity of heating throughout the height and length of a coke oven wall, when these dimensions were increased, were referred to, as well as the relative importance of radiation, conduction, and convection in heat transmission to the oven walls. Increase in the length of an oven wall, particularly when accompanied by increase in the height and decrease in width of the oven, i.e., with quicker coking, gave a much larger volume of gas to be carried per unit of time in the common flues. The application of Bernoulli's theorem to the difficulties associated with uniformity of gas and air distribution to each vertical flue in a set of flues was discussed.

Uniformity of heating throughout the height of an oven wall depended on the type of flame and its shape, which was affected by the velocity and temperature of the gas and air entering each flue, the design and inclination of the gas and air channels, as well as the design of the flue. The importance of the composition of the coke-oven gas, and the application of producer gas and blast furnace gas, or the addition of waste gas with the air in coke oven gas heating to lengthen the flames was also dealt with. In discussing the mechanism of heat transfer, reference was made to the essential difference between the methods involved in heat transmission from vertical and from horizontal flues, and to the importance of current velocity in horizontally flued ovens. A collection of published work on radiation from flames was made, though a direct application to the problem of coke oven heating was as yet not possible.

Discussion

The CHAIRMAN said that in reading the paper he had been very much struck by the attempt that had been made—and he hoped it was an attempt which would be made more in the future—to place considerations of the design of the furnaces and coke ovens, and so on, upon a more rational basis. It was an attempt to get down to some of the principles underlying design, and for that reason alone was warmly to be welcomed.

Sir ARTHUR DUCKHAM said that great benefits would accrue if the scientific side of research got closer into touch with the commercial side of research. That, as a matter of fact, was taking place to a quite considerable extent. In the case of his own companies, for instance, in designing ovens or carbonising plants they made calculations and sometimes burned their

fingers, more or less, with every plant that was put in. Plants were installed and certain troubles arose. They were corrected, and so things went on. It would, however, be to the greatest advantage to their friends in Sheffield and in Leeds if the practical knowledge so obtained could be made use of by more scientific workers in the universities.

Professor J. W. HINCHLEY suggested that a careful study should be made of the individual flues of the coke oven, especially at the junction of the flues, and where the changes in velocity took place, and where eddies were formed.

Disposal of Surplus Coke Oven Gas

After reviewing the various possible uses for the surplus gas available from coke ovens, Mr. C. P. FINN, in his paper on "The Disposal of Surplus Coke Oven Gas for Public Supply," drew attention to the extensive and growing practice in the United States of regarding the coke oven as a primary source of gas for public supply, and incidentally the use of by-product oven coke for central and domestic heating. It was pointed out that the use of coke-oven gas for public purposes in England had developed slowly, though to a greater extent in Yorkshire. Examples were cited of large and small towns which actually used the gas and of others which, although adjacent to likely supplies, appeared to have ignored the opportunity at hand.

After the requirements of those towns actually in the coalfields had been met, there should be no difficulty in supplying places further afield. Long distance pipelines from the pit-head would reduce transit and marketing costs of raw coal, and bulk carbonising on the coalfields should secure economy of production. The whole supply of gas in a group of the Dearne Valley townships, extending over about 17½ square miles, was supplied from the Manvers Main Company's coke ovens, and from his experience the author concluded that the statutory requirements might be met without recourse to double collecting mains or other devices to produce suitable gas. Analyses and data were given showing that a gas undertaking need have no qualms as to taking surplus coke-oven gas. The paper included a bibliography relating to the subject, and the author submitted that Great Britain had not yet exploited to the full the possibilities of the by-product ovens, and pointed out that it was capable of producing suitable gaseous, liquid, and solid (metallurgical and domestic) fuels, a fact which appeared to have been overlooked by many advocates of less tried and even untried processes of coal carbonisation.

An American Comment

Mr. FULWELL (Philadelphia) said the solution of the question of coke oven gas, *versus* other forms of gas was very largely a matter of the coke market. A supply of gas continuously could not be relied upon unless there was a permanent market for the coke from the ovens. In the contracts that had been made in the United States he did not believe a continuous supply of coke oven gas had been provided for. If the steel industry went flat, then they reserved the right to shut down the coke ovens, and so it was necessary to have a standby plant in order that the town supply of gas should be maintained. That was certainly an objection. The practice in the United States was to take the coke oven gas unpurified, and then to purify it in the gasworks. Then there was the question of the uniformity of the supply, especially where the coke ovens were working in conjunction with a steelworks. In these circumstances it would nearly always be found that the supply of gas varied from hour to hour, and it required very close co-operation between the gasworks manager and the coke oven manager to secure uniformity in this respect. No difficulty had been experienced in obtaining fairly uniform heating value, but it was always essential to keep some form of benzol vaporiser available for emergency.

Mr. WADSWORTH mentioned that the organic sulphur content of coke oven gas was considerably lower than that of coal gas when the benzol was extracted.

Mr. J. W. LEE (Chesterfield) said that the prejudice of the gas engineer had to be overcome, and that could best be done by proving to the gas engineer that the coke oven industry could supply a suitable gas.

Mr. FINN said that he had just been asked in a written message if there was any drop in the calorific value of the gas after it passed through the saturator, before benzol recovery. In his particular case the ammonia recovery was

indirect so that the gas did not pass through a saturator at all.

Mr. Wadsworth had mentioned the sulphur content. The sulphuretted hydrogen content of his own gas was 320 grains per 100 cubic ft., and, in passing, he might add that the hydrocyanic acid content was only 2 to 3 grains per 100 c. ft. expressed as HCN, which was considerably lower than in the case of most ordinary gasworks.

Solid Absorbents for Benzol Recovery

Mr. W. H. HOFFERT, in a paper on "A Comparison of Solid Absorbents proposed for Benzol Recovery," said that, up to the present, benzol recovered from coal and coke-oven gases had been the only home-produced motor spirit. In this country it was recovered by washing the gas with a suitable oil. During the past few years, however, attention had been drawn to the possibility of recovering the benzol by using certain solids, which had the property of taking up or adsorbing considerable quantities of gases and vapours. The solid adsorbents which had received most attention were active carbon and silica gel. Iron oxide gel has also been suggested for the same purpose. In applying such adsorbents to benzol recovery, besides the efficiency with which the benzol could be removed from the gas by the adsorbent, the maximum quantity of benzol which the adsorbent would take up from the gas under the existing conditions and the ease with which the adsorbed benzol could be removed from the adsorbent and the length of efficiency of the adsorbent were important considerations on which the cost of working the process would largely depend. The paper gave results obtained from a systematic examination of these adsorbents in the laboratory under conditions resembling those of recovery practice.

The following comparative table was drawn up :-

Maximum quantities of benzene taken up at saturation by the adsorbent at 20° C. in the dry condition, from a gas containing 2½ gallons of benzol per 12,000 cub. ft. and saturated with water at 18° C.

	Grams of C ₆ H ₆ adsorbed per 100 g. adsorbent	Grams of C ₆ H ₆ adsorbed per 100 c.c. adsorbent space
Active carbon	15-30	5.8-11.6
Silica gel	8-14	5.7-10.0
Iron oxide gel	4-16	4.6-7.0

It was pointed out that although, from the point of view of adsorption by the dry adsorbents, selectivity was not of great significance under benzol recovery conditions, this property was important when considering the removal of the adsorbed benzol. In the case of active carbon, steam could be used to remove the benzol, whilst with silica gel the adsorbed benzol was best removed by means of dry heat. Iron oxide gel, which had a smaller adsorptive capacity than active carbon and silica gel under benzol recovery conditions, besides being selective towards water vapour, suffered from the further disadvantage that it could not be heated above 250° C. without destroying its adsorptive properties. The conclusion was drawn that the adsorbent processes for recovering benzol offered many advantages over the oil washing process, such as greater efficiency of extraction, smaller heat requirements, and a better product requiring less refining. It was hoped that satisfactory data as to the stability of these adsorbents under benzol recovery conditions would be available in the near future, so that a definite comparison of the adsorbent and oil-washing processes for recovering benzol from coal and coke-oven gases could be made.

Silica Gel Investigated

The CHAIRMAN said the statements that had been made concerning these different solid adsorbents were not always consistent with one another, and it was felt necessary by the Joint Committee of the National Benzol Association and the Leeds University, by whose permission the paper was published, to make a survey of the behaviour of two or three of these adsorbents, particularly silica gel and various forms of activated carbon, in order to know, with some exactness, what behaviour could be expected from them in the narrow field with which benzol recovery in coke oven practice and in gasworks practice was solely concerned.

Mr. J. ARTHUR REAVELL said it would have been better if they had known more as to the grade of gel that was used. There was an impression about that there was only one grade

of gel but, on the contrary, there were a great many grades, and if as much information had been given in the paper as to the grade of gel used as there was concerning the carbon used, it would have helped to a better understanding of the results put forward.

He had understood the author of the paper to say that it was impossible to steam out silica gel. That, however, must be a misunderstanding, because there were commercial installations running in England to-day in which the gel was steamed out directly to get rid of the benzol. With regard to tar fog, his experience had shown that in silica gel this was an absolute bogey. The gel had been used over and over again for two or three years. Further, in connection with experimental work on benzene from coke oven and coal gas, silica gel had been recovered constantly and continuously in the second stage of activation by the high temperature without any trouble whatever and without any signs of the gel deteriorating in any way. Powdered gel would be used by anyone who was making recovery on a large scale. In taking out the benzene from coke oven gas and also removing the ammonia, experiments on a fairly large scale had shown that from the first activator ammoniacal liquor was obtained, and he was not at all sure that there was not a large field for silica gel for this purpose.

Recovery of Oil from Shale

A large number of experiments were made on the recovery of shale oils as well as benzol, and shale oils recovered very well indeed. In a number of plants he had erected in Spain over a long period he found that the recovery with shale oils was about 50 per cent. in summer and 70 per cent. in winter, but in the hottest summer which Spain had a year ago, the recovery with silica gel showed 90 to 95 per cent. In the recovery of oil from shale it was difficult to finish the refining with gel, and at the moment there certainly seemed a snag as far as gel was concerned in finishing the refining of the benzol, *i.e.*, the light oil recovered from coke oven gases, because an acid gel had to be used to get good benzene. An acid gel meant that it was necessary to

put about 0.6 per cent. of acid into the gel on its way to the filters or other medium that was being used to bring the gel into contact with the oil. Chemical engineers would at once realise a difficulty if there was 0.6 per cent. of acid always going in and afterwards had to be recovered by heat, especially when it came to the second regeneration where the temperature was very high. From the laboratory point of view it was possible to make a perfect product with a slightly acid gel and then finish off with a neutral gel.

One of the oil companies in this country had been manufacturing and using silica gel for refining purposes for over 20 years, and the discovery of the manufacture of silica gel was made by an English chemist, and the process was worked by English chemists quite successfully.

Further Discussion

Mr. F. H. CARR said he wished to urge the author to try to arrive at a method for use in the laboratory by which to judge the adsorbent activity of various substances of the same nature, *i.e.*, different carbons or different samples of iron oxide or other adsorbents.

Mr. E. V. EVANS said that the point of the process mentioned in the paper seemed to lie in the possibility of the complete removal of naphthalene and a very appreciable removal of carbon bisulphide and thiophenic substances from gas.

Mr. B. WILSON HAIGH (Jharia Coalfield, India) said that where benzol plants were in existence in the tropics—and there were several in India—there was a good field for working the silica gel process.

Replying, Mr. HOFFERT said that it had been necessary to take a gel which was suitable for the concentration at which benzene existed in the coal gas, and he was surprised to hear that the gel could actually be steamed out and yet not leave any water in. Mr. Reavell had stated that the gel could be used repeatedly, and that was the kind of information he was trying to get, which would be of invaluable help in future research.

Smokeless Fuel Problems

On Thursday there was a symposium on "Smokeless Fuel" organised by the Chemical Engineering Group of the Society, at which Sir Arthur Duckham presided. In his opening remarks he drew attention to a demonstration of coke fires in an adjoining room, and expressed thanks to Dr. E. W. Smith and the Leeds Corporation Gas undertaking for their trouble in arranging this exhibit.

The Present Position and Future Possibilities

A paper prepared by Dr. LANDER, Director of Fuel Research, and Dr. MARGARET FISCHENDEN, entitled "Smokeless Fuel—the Present Position and Future Possibilities," was read by Dr. FISCHENDEN, who said that the problem was as to how the 90 million tons of bituminous coal used every year for steam raising purposes, and the 40 million tons used by domestic consumers could be profitably subjected to some form of preliminary treatment, whereby the by-products might be recovered and the emission of noxious smoke checked. The requirements of a satisfactory solid smokeless fuel in this country might be summarised briefly as follows:—

1. It must have been previously treated for the recovery of valuable by-products from the raw coal and so rendered smokeless.
2. It must contain sufficient volatile matter—say, 7–10 per cent.—or be of such a structure as to be easily kindled and kept alight in open fireplaces as at present constructed.
3. It must have a relatively low ash content; partly to prevent an undue reduction in its calorific value, and partly to reduce the dust resultant upon combustion when burned in household fires, and to reduce clinkering when burned in boiler furnaces.
4. It must not be so friable as to break easily during handling and transport.
5. It must be compact, but not of such a structure that the ash formed during combustion covers the surface of the fuel in such a manner as to hinder combustion.
6. Its price must be sufficiently low, so that when the other

advantages are taken into account it will attract purchasers away from bituminous coals.

The high-temperature carbonisation process, as practised at the gasworks, would usually fulfil all the above conditions except the second. Moreover, the normal gasworks practice is one which has been long established, and at the present time is the only proved economic process for the production of solid smokeless fuel, other than metallurgical coke, which utilises high temperatures of carbonisation. An easy course towards the early elimination of the industrial smoke nuisance would therefore appear to offer itself through the medium of the pre-carbonisation of the coal used.

Although the gas yielded from the carbonisation of such an amount of coal as would produce coke sufficient for all steam raising purposes would be far in excess of any demand at present likely to be created, a steady market for coke would result in a reduction in the price of gas, and a consequent increase in its use; and that coke will in many cases gradually replace coal might confidently be anticipated. Increase in the use of coke would inevitably be associated with increase in the use of gas, and it was by a combination of coke, gas and electric power, each utilised in the cases to which it was more particularly applicable, that the abolition of industrial smoke would probably be effected.

Properties and Uses

In a paper on this subject Mr. EDGAR C. EVANS (National Federation of Iron and Steel Manufacturers) gave the following simple classification of smokeless fuels:—

- (1) Natural smokeless fuels.
 - (a) Anthracite. (b) Dry steam coal.
- (2) Coke made at high temperatures.
 - Gas coke:—(a) Horizontal retort coke. (b) Vertical retort coke. (c) Chamber coke. Blast furnace coke:—(a) Beehive coke. (b) Oven coke. Specially reactive high-temperature cokes.
- (3) Low-temperature cokes.

Although the gas companies of the country made all possible attempts to increase the popularity of gas coke, it suffered from the following disadvantages:—

- (1) Its high moisture-content increased the difficulty of ignition and reduced its radiating efficiency.
- (2) It had very frequently a high ash content.
- (3) Gas coke did not burn readily in open grates.
- (4) Gas coke was frequently sold ungraded.
- (5) Gas coke smelt of "sulphur."

Instead of making their coke to suit British requirements, the gas industry had advocated the scrapping of existing grates and ranges for a type that would more conveniently burn the material they produce. But these disadvantages could be remedied in so far as existing grates were concerned by increasing the reactivity of the coke produced.

Coke Reactivity

The term "reactivity," meant generally the power of the fuel of reacting with oxygen or air, and in the course of a joint investigation made by the Fuel Research Board and the National Federation of Iron and Steel Manufacturers, the simple method of passing a standard volume of carbon dioxide at a standard rate over a standard volume of coke between 10- and 20-mesh size heated to 950° was adopted, and the reactivity measured by the volume of carbon monoxide produced. A series of tests made with this method had given the following results.

Range of reactivity values for different cokes.

	c.c. of CO obtained.
Theoretical coke of maximum reactivity.....	200
Active carbon	192
S. Wales metallurgical coke	78
Scotch metallurgical coke	54
Glover-West high temperature vertical retort coke from Durham coal	119
Beehive coke—Durham	30
Glover-West high temperature vertical retort coke from Ravine coal—20 per cent. steam.....	142

The following were suggested methods of increasing the reactivity of high-temperature coke:

1. Coal blending.—Blending of fusible and non-fusible coals was possibly more easily accomplished in gasworks purchasing their coal at coke ovens attached to individual collieries. Accurate blending involved capital outlay, but as cheap coals could replace a proportion of the expensive gas coals now used, the total cost per ton carbonised would probably not be increased.
2. Addition of coke breeze.—Alternative to blending there were certain advantages in intimately mixing coke breeze with coal prior to carbonisation.
3. Fine grinding.—This increased the reactivity of the coke made, and had proved advantageous in by-product coke production.
4. Addition of inorganic material.—This field was practically unexplored on a large scale. It would necessitate the use of clean coal.
5. Character of the retort.—Horizontal gas retorts gave more reactive coke than by-product coke ovens, while ovens of the recent narrow type gave a more reactive coke than wide coke ovens.

Discussion

Mr. H. J. HODSMAN said he spoke as a consumer of fuel, who had experimented with different fuels in an ordinary grate. The question of ignition had not worried him because, for reasons of convenience, he had always lit his fires with an auxiliary gas burner, and as the result of this work he had come to the conclusion that the obtaining of satisfactory results is all a question of the shape of the grate. The shallow fire grate limited the range of fuels which could be burned, and therefore the step already taken should be retraced, and the five bars put back again.

Mr. V. R. CHADWICK said he was specially interested in coke breeze, and gas undertakings or others need not be expected to put extra work into its production, because it was essentially a waste product, and, as such, could be sold at a good price. From a number of fairly extensive experiments he had found that coke breeze mixed with a small quantity of bituminous coal, in the proportion of 12 to 15 per cent., gave an ideal fuel which could be expected to give as much steam under ordinary conditions as a fairly good coal.

Dr. R. LESSING said that what had to be done was the

proper selection of coal and a proper preparation of coals before they were carbonised. His own work had convinced him that the ash content in the coal was one of the turning points in our future carbonisation policy. Not only was the ash a great disadvantage to the coke, but it had a profound influence on the other properties, such as the internal structure of the coke. With regard to Mr. Chadwick's remark as to coke breeze being a waste product, and yet getting a market, of course there was no waste product which did not find a market. It was not so important to find a market to utilise the breeze as to avoid making it. Whatever could be done with coke breeze in the way of firing boilers could also be done with the raw material which went to form the coke breeze, without putting it through the coke oven or gas retort and spending enormous amounts of heat in doing so.

Mr. HAROLD NELSON said that Dr. Fischenden had raised the question of the amount of low grade gas obtained when employing internal heat, but it all depended on the manner in which that internal heat was applied. The indications were that in the future it would be necessary to divide the treatment of coal into two distinct phases. First, the moisture would be dried off by heating the coal up to about 200° C. in an ordinary internally heated dryer, as used everywhere on the Continent; and in the second, the coal would go into a trough and be heated by circulating gas.

Professor J. W. COBB (Leeds University), in joining Sir Arthur Duckham in thanking those who had brought forward these papers as impartial and competent authorities, said that it had become very clear that there are two parts to the study of this problem of solid smokeless fuel. One of them was the fuel itself, and the other was the grate used for the combustion of such fuels. It had been clearly demonstrated that a proper construction of grate for the burning of coke ought to be worked out, and, as a matter of fact, was being worked out, which would render a solution of this solid smokeless fuel problem very much simpler, more complete, and generally applicable.

Dr. FISCHENDEN, replying to the discussion, said that personally she thought the modern grate was entirely wrong in design, at any rate in some respects. A low narrow grate was fundamentally wrong, but where the modern grate really did score, was that it has better draught control than the old-fashioned grate. The best design of grate was one with a big vertical front and very narrow from back to front for the fuel bed. Her experience with these fuels was that if they are put on the thinnest glowing bed, they would burn up quickly, but that they were not easy to light with wood.

Mr. EVANS said that one point arising out of Mr. Chadwick's remarks was the necessity for standardising coke sizes in this country. Various people sold coke and coke breeze, and they offered varying efficiencies, but nothing was said as to what the size was. If they could get down to a basis of standard sizes for various cokes, as the result of this discussion, then it would have been well worth while holding the meeting on that account alone.

Tars and Oils from Coal

In calling upon Mr. F. S. SINNATT, who read a paper prepared in conjunction with Mr. J. G. KING on "A Study of Tars and Oils Obtained from Coal," the chairman said this dealt with a subject which required almost as much clarification as did the subject of a really satisfactory smokeless fuel. A real appreciation of this question of tars and oils from the carbonisation of coal was the basis of the smokeless fuel industry, because unless a satisfactory tar-oil result was obtained, no process of carbonisation would give a satisfactory result or economical process as far as finance was concerned.

In dealing with low-temperature tar, Mr. SINNATT said that some confusion had arisen by the indiscriminate use of the words tar and oil. He proposed to describe the crude product obtained by the carbonisation of coal as tar, and to reserve the word oil for those liquids which had been recovered from this tar and which were free from pitch or asphaltic substances. After describing the treatment of low-temperature tar by distillation and separation, and discussing its constituents, it had to be concluded that a great deal of research work was necessary to determine what constituents of low-temperature tar were of value. Until this was accomplished the immediate value of this tar must remain that of fuel oil.

The Conversion of Coal into Oil by Hydrogenation

The work of Bergius in Germany on the practical application of hydrogenation to coal has aroused great interest both from a scientific point of view and as a possible means of obtaining high yields of oil from coal. The phenomenon of hydrogenation is closely connected with that of dissociation, regarding which much accurate information was collected during the nineteenth century, notably by Berthelot. In 1904 Ipatiev commenced a long and important series of experiments, in which he heated various organic compounds in an autoclave to a high temperature (800°–900°) and under a pressure of 600 atmospheres. His preliminary results indicated that the type of reaction which took place was independent of the pressure, but that the rate of reaction was a function of the inverse of the pressure and was also influenced by the presence of various catalysts (Fe, Al₂O₃, Ni, Ni₂O₃, etc.). Having proved that the reactions which took place were invariably accompanied by the liberation of hydrogen, Ipatiev repeated his experiments in the presence of hydrogen and under lower pressures of 100 atmospheres, and the results obtained indicated that the products of reaction were more fully hydrogenated, and that the presence of catalysts—especially iron—had again a marked influence in increasing the rate of reaction.

While Ipatiev was pursuing a remarkable series of researches on these lines there appeared in Germany on May 5, 1913, and in France on April 6, 1914, a patent by Bergius claiming the production from heavy hydrocarbons of light hydrocarbons by the action of inert gases under pressure. Numerous other patents then followed, dealing chiefly with the mechanical difficulties arising out of the necessity of working at high pressures and at high temperatures, and also making provision for the adaptation of the process to solid fuels. An experimental factory was established at Mannheim, Rhineland, at which were installed three types of plant: (1) an intermittent one of laboratory size having a capacity of 2 litres; (2) a continuous plant, intermediate in size between the former and large-scale practice, having a throughput of about 20 kg. of coal per hour; and (3) a plant capable of dealing with 30 tons of raw material per day. Coal has not yet been heated in this latter plant.

Conditions Favourable to the Process

The following conditions favourable to the "berginisation" of coal have been established. The coal to be treated must contain less than 85 per cent. of carbon, and non-caking coals are more amenable than caking coals. It is necessary for the coal to be finely powdered and in suspension in a suitable diluent. It would also appear that the results of the treatment are intimately connected with the relationship holding between the chemical constitution of the coal to be hydrogenated and that of the liquid diluent used as excipient. The initial pressure of hydrogen and the most suitable temperature at which to carry out the operation are variable and depend upon the material used. The presence of sulphur and other catalyst poisons have a deleterious effect. As in the case of all reactions where dissociation and systems of equilibrium are concerned, complete transformation can only be obtained when some of the products are removed from the sphere of reaction as formed, thus allowing the reaction to proceed towards completion. The realisation of these conditions during berginisation favours the production of light hydrocarbon spirits suitable for use in internal-combustion engines as against heavier oils and tarry products, which can only be used as boiler fuel oils or for the production of lubricating oil. For these reasons the continuous, intermediate-scale plant was developed.

Actual figures obtained by the use of this plant at Mannheim are not available, but it is possible to state that certain British coals have been transformed into liquid and gaseous products to the extent of 85 per cent. by weight at the expense of hydrogen equal to 10 per cent. by weight of the coal. Accompanying the liquid products is a quantity of gas of high calorific value, which consists chiefly of a mixture of hydrogen with saturated hydrocarbons of low molecular weight in which methane, ethane, and propane predominate.

The problem of hydrogenation is being studied in other centres, and Kling and collaborators, in France, have in essence confirmed the claims made by Bergius. Graham and Shatwell at Birmingham have approached the problem from a special aspect, in that they have endeavoured to use as

excipient a liquid (phenol) which is itself unaffected during the hydrogenation, in order that the oils obtained should consist only of those derived from the coal itself.

Results at the Fuel Research Station

Some preliminary work at the Fuel Research Station on this subject has for its particular object the examination of characteristic English coals. A laboratory size bomb of 2 litres capacity has so far been used exclusively. The following typical results may be quoted from a particular experiment:—140 g. of coarsely powdered Arley coal were mixed with 70 g. of vertical retort low-temperature tar, from which had been removed the fractions boiling below 230°; 15 g. of "lux-masse" were incorporated with this paste and the charge was placed in the bomb together with 200 g. of flint pebbles. The initial pressure of hydrogen was 100 atmospheres. The bomb was heated to the reaction temperature (470°) and there retained for a period of one hour, the maximum pressure attained being 223 atmospheres. On cooling, the final pressure registered was 47 atmospheres. On releasing the pressure 2·17 cu. ft. (42·0 gr.) of gas consisting chiefly of saturated hydrocarbons (57·5 per cent.) and hydrogen (39·2 per cent.) of *d*₀ 561 (air=1) were obtained. In calculating the results to coal only, use had to be made of a blank experiment in which tar only was treated. The conversion of coal into oil amounted therefore to 46·7 per cent. by weight of coal charged or 48·2 per cent. of the ash-free, dry coal substance. The total conversion into oil and gas amounted to 70·5 per cent. of the dry, ash-free coal.

Little work has been published upon the composition of the oils obtained by the berginisation of coal, but although the knowledge of the subject is scanty, these oils are of peculiar interest to the chemist. They appear to consist of a mixture of hydrocarbons of the paraffin, naphthene, and benzene series associated with relatively smaller amounts of unsaturated hydrocarbons. The percentage of phenol and its homologues present in the light fractions is small—certainly less than 1 per cent.—but on the other hand there may be as much as 20 per cent. of phenolic bodies in the heavier oils. These substances are high-boiling liquids, not easily extractable with caustic soda, but susceptible to resinification by this reagent. It is interesting to note that the total oils obtained in five experiments on coal at the Fuel Research Station contained only 2 per cent. of phenols. The fact that aromatic hydrocarbons are normal constituents of the oil is of some importance.

In conclusion, it may be said that the process of berginisation is of great interest. The production of hydrogen of (say) 95 per cent. purity must affect the economic side of the problem.

A Parliamentary Science Party

To the Editor of THE CHEMICAL AGE.

SIR,—Some years ago I drew attention in the scientific and general press to the need of a small Science Party in the House of Commons. This need is greater to-day than ever, and a useful step in this direction would be the formation of a Science Committee consisting of all present members who are directly interested in this subject, which committee could watch and influence progress in many useful directions.

The need is an insistent one, as questions of health, working conditions, the development of new industries such as those of artificial silk, and fertilisers produced from the nitrogen in the atmosphere—which industries are of extreme importance to the textile and agricultural industries respectively, and have a direct bearing upon unemployment—require almost immediate attention. A weak link in the industrial chain influences many other industries, and lowers general efficiency in many directions.

This new interest in science will afford a common platform on which all parties can meet and work together. It is also important that the followers of science should take a more direct part in legislation, when this general interest would counteract any increasing division of these workers into water-tight compartments, and also counteract the growth of that cast-iron professionalism which, when carried too far, becomes a handicap to further progress on general lines.—Yours, etc., Hampstead Heath, N.W.3.

July 20.

W. P. DREAPER, O.B.E., F.I.C.

Chemical Engineers at Leeds

Annual Meeting of the Institution

THE annual general meeting of the Institution of Chemical Engineers was held jointly with the American Institute of Chemical Engineers in the Philosophical Hall, Leeds, on Friday, following the meetings of the Society of Chemical Industry. In the morning the annual general business meeting was held, followed by addresses by Dr. C. L. Reese, President of the American Institute of Chemical Engineers, and Sir Arthur Duckham, President of the Institution of Chemical Engineers. A symposium on "Industrial Water Supply and Stream Pollution" was held, at which nine papers were read, and was followed by a discussion in the afternoon.

Annual Report

The report of the Council for the past year showed that the membership now amounted to 295. The Education Committee had revised the memorandum on the training of a chemical engineer in the light of a large number of expressions of opinion received from the leaders of industry throughout the country, and steps were being taken to bring it to the notice of education authorities with a view to their co-operation in regard to the training of chemical engineers. The secretary of the Apprenticeship and Training Board, Royal Arsenal, Woolwich, had submitted to the Education Committee for their comments and suggestions a scheme for the training of chemical engineering apprentices. Arrangements were being made for the first public examination for associate-membership to be held towards the end of 1925. The Appointments Bureau was already doing good work. There was a slight deficit on the year's working.

On the motion of Sir Arthur Duckham, seconded by Mr. J. A. Reavell, the report and accounts were adopted. It was announced that Sir Frederic Nathan had been elected president for the coming year.

Address by Dr. C. L. Reese

Dr. C. L. REESE, who addressed the meeting mainly on the question of the education of chemical engineers, again expressed the warm appreciation of the American visitors at the manner in which they were being entertained by British chemists and chemical engineers. Asking the question "What is a chemical engineer?" he said that in America they had been quite unable to come to any agreement on a definition. There were many who held the view, and he was among them, that the best chemical engineer was the man who had had a thorough training in the principles of chemistry and had afterwards obtained experience of engineering. The Massachusetts Institute of Technology had, perhaps, done most to establish the modern idea of what a chemical engineer's qualifications should be. Their idea was that a chemical engineer was one who had learned the elementary processes, such as distillation, filtration, precipitation, combustion, and so on. Every chemical engineer, of course, must become a specialist, because no one man could know all there was to know on all subjects. The main object of the chemical engineer was service, and to make the world a better place to live in.

Dr. Reese said he wished to warn the young chemical engineer or chemist, and those who were training him, that one of the great difficulties with men trained in chemistry, was that they talked a different language from the ordinary man, and technical men too often could not talk to their superiors, and commercial and financial men, in the language which those people understood. Every endeavour must be made to use plain language in their reports. The full technical details should be there for the purposes of record, but the facts should be stated in language which ordinary people understood. He had had chemists working under him whose salaries ran into four figures. He had had more trouble with research men and chemical engineers to get them to write their reports in terms that could be understood by the ordinary person than in any other direction. Their English was not good, and they did not know how to put into the English language the information they wished to convey. The great aim of the chemical engineer should be to get on to the executive of the business in which he was engaged, and for that purpose the chemical engineer must have a training in economics.

It had, he said, been the aim of the American Institute of Chemical Engineers to set some standard for chemical engineer-

ing education. His own view was that a man must have a liberal general education in the first place, after which he ought to spend four to six years in chemical engineering training, and eight years if it were possible. Generally speaking, however, it was necessary to work on the basis of a four years' course, although personally he did not think it long enough. After 1929 all students wishing to become members of the American Institute of Chemical Engineers will have to have been trained at one of the approved colleges.

Sir Arthur Duckham's Address

SIR ARTHUR DUCKHAM, in the course of his presidential address, welcomed the opportunity of meeting the American engineers. The chief responsibility of the Institution of Chemical Engineers was to organise courses of technical education and institute examinations which would develop and stamp students as chemical engineers. The Council had had the temerity to attempt a definition, which was as follows: "A chemical engineer is a professional man experienced in the design, construction, and operation of plant and works in which matter undergoes a change of state and composition." That definition was rather wide, but he thought most of them could qualify on those lines, and it would not be quite so difficult to comply with as the American idea. Reviewing the conditions in the coal and other industries, he deprecated both State subsidies and State control, and urged that the cure for industry lay within the industry, and that all the Government could do was to bring the parties together sympathetically, study their difficulties, and help development by extending financial support to approved schemes. Dealing with co-operation, he said that the first necessity was to induce confidence. The ultimate aim of all parties must be the same—a prosperous industry. The Government, instead of considering the development of electrical supply, low temperature carbonisation, and other industrial questions, would do better to study how they could cheapen the price of coal and coke by assisting financially, with advances on economical lines, the development of the coal industry. That would be the quickest way to bring prosperity back to this country. It was there that the chemical engineer came in. The coal came out of the pit, and the necessity for cleaning that coal was imperative, and that was the chemical engineer's job.

Coke Oven Development

Dealing with the question of coke ovens, which was essentially a chemical engineer's job, he said that if these were tackled properly he was certain that the price of coke could be reduced by 3s., 4s., or even 5s. per ton over the price of coke from the ovens put up pre-war or during the rush war period. Our chief competitors to-day were Germany and America, although America did not interfere with us very much. Those who had visited these countries must have been amazed at the tremendous development that was going on there, especially with coke oven development and improved by-product working. If there was economical by-product working, if we had an economical run upwards, and proper use of the gas made in the coke ovens, and proper use of the tars and by-products, the price of coke would immediately come down, and the price of coke would at once be reflected in the price of pig iron and steel. How was it that Germany could build coke ovens to-day in large quantities? In this country we were not building any coke ovens; only one or two orders had been placed in this country for coke ovens during the past fifteen months.

In every industry, chemical engineers were wanted as the administrators of factories. He did not think it at all necessary that a chemical engineer should have chemical knowledge only, but if a chemical engineer did take an administrative job he was far better qualified than the man who had only had a commercial training or an industrial training in the normal way. Our really great leaders had had technical training. If he might take an industry in which he was specially interested—the gas industry—the great leaders in the past like Sir Corbett Woodall, Sir George Livesey, Mr. Charles Hunt, and others, who had made the industry what it is, were all technical men, and to-day one of the dangers of the gas industry was that the leaders were not technical

men. Men like Mr. Milne Watson had done most wonderful service, but if Mr. Milne Watson had associated with him men of the stamp to whom he had just referred, he was certain that their technical training would have been of the highest value in assisting him in his very difficult work. The future was extraordinarily promising for chemical engineers, and he was certain that chemical engineers had the plums of industry before them.

On the motion of Professor D. D. JACKSON (United States), seconded by Professor E. BARTOW (United States), a hearty vote of thanks was accorded Sir Arthur Duckham for his address.

Effluents from Ammonia Plants and Their Disposal

Dr. T. LEWIS BAILEY, in a paper on this subject, said that the origin of these effluents in England was essentially twofold—viz., the treatment of ammoniacal liquors produced at coke ovens and gasworks; in each case the carbonisation of coal gave rise to the constituents of the ammoniacal liquor, which itself was produced by first cooling the crude gas and then scrubbing it with water. Giving a detailed analysis of the liquors, Dr. Bailey said that the one outstanding feature was the low thiocyanate content of coke oven liquors as compared with that existing in other liquors. The practical problems were: (1) How can contact of tar and ammoniacal liquor be reduced to a minimum? (2) To what extent can thiocyanate and thiosulphate be kept out of ammoniacal liquor? (3) How far is it possible to reduce the volume of effluent?

In coke oven practice, where direct sulphate recovery was adopted, separation of tar was effected at an early stage of the operations by one of several methods, all of which brought about separation of the tar at a temperature which was somewhat above dew-point—viz., 70°–80° C. The various methods adopted were: (a) The use of a liquor spray, operated at a pressure of something like 80 lb. on the sq. in. (b) A combination of a cyclone separator (for the heavier tar) followed by a dynamic tar extractor, in which rapidly rotating vanes produce agglomeration of the finer tar particles. A similar principle was involved in a type of tar extractor used on water-gas plants—high-speed currents of cool gas were forced into hot gas.

Such methods are capable of removing 95 per cent. of the tar in the first instance.

Authorities differed as to the origin of the thiocyanate as a normal constituent of ammoniacal liquors, but there was little doubt that it was derived from two sources: (1) As a product of the interaction in solution of ammonia and carbon bisulphide, or of ammonium sulphide (or polysulphide) and carbon bisulphide. (2) As a product of the interaction in solution of ammonium cyanide and ammonium polysulphide, or of hydrocyanic acid, sulphuretted hydrogen, ammonia and oxygen. Dr. Bailey also dealt with the biological treatment of effluents, and gave data from numerous experiments.

Discussion

In the discussion, Professor D. D. Jackson (United States), Dr. T. Campbell Finlayson, Dr. E. W. Smith, and Dr. A. L. Booth took part. Points raised included the question of whether the removal of the phenols would satisfy the conditions of sewage disposal, and whether the presence of the cyanates was of importance. The need for new methods for washing out ammonia was emphasised.

The CHAIRMAN, in expressing thanks to Dr. Bailey, said that normally there seemed to be very few Government officials who took the side of the manufacturer. They were always telling him what he must do, but not how he was going to do it. Dr. Bailey appeared to be equally interested on both sides of the question, and that was really a rare thing.

Then followed three papers by American members: "Wool Scouring Waste Liquors, Composition and Disposal," by F. P. Veitch and L. C. Benedict; "Electrolytic Conductivity and Hydrogen Ion Control," by H. C. Parker; "Distillery Waste Liquids and their Purification," by R. D. Littlefield. "The Preparation and Comparative Performance of Base Exchange Materials in Water Softening" was the subject of a paper by E. B. HIGGINS and J. P. O'CALLAGHAN. The authors dealt with the application of the base-exchange process of water softening, and said that the vogue of the

zeolite softener was increasing remarkably in the United Kingdom, Europe, and America.

Water Softening Progress

The advantages which the base-exchange method possessed as compared with precipitation processes, were, first and foremost, that the base-exchange method was the only treatment, short of distillation, which entirely removed the hardness-forming bases, calcium and magnesium, from the water. Secondly, it did not require adjustment to enable it to deal with variations in the hardness of the water or with a different water supply. Thirdly, the waste effluent from a zeolite plant containing the removed bases was liquid, and could be discharged to any drain, so that the problem of sludge disposal—a formidable item in the case of a large lime-soda plant—was completely absent. Lastly, the zeolite process could be operated under pressure, thus avoiding in most cases the necessity for double pumping and enabling the softener to be placed in any convenient position.

Water Softeners, Ltd., who had introduced the Gans Zeolite into this country, now made a satisfactory substitute, "Permutit," and it had been found that green sand or glauconite, when suitably treated, was an efficient water softener. The first synthetic zeolite was produced by Water Softeners, Ltd., and the best results were obtained when the ratios were as follows: Silica (SiO_2)—40–60 per cent.; Al_2O_3 —25–38 per cent.; Na_2O , 10–30 per cent.; and the best results of all came from a mixture of SiO_2 , 52 per cent.; Al_2O_3 , 29 per cent.; and Na_2O , 19 per cent.; this was "Permutit 31."

Contamination of the water to be softened with oil or tar was another serious matter in the case of the synthetic zeolite plant; but, however badly contaminated with oil or tar the bed of a natural zeolite plant might become, it could be at once restored to full activity by a roasting process.

Trade Names

Dr. J. C. OLSEN (United States) said that the use of zeolites resulted in the water being distinctly alkaline after treatment, depending on the amount of temporary hardness, and that distinctly limited the field for these water softening agents.

Professor E. BARTOW (United States) said that it was not the practice in America to mention trade names in papers read before their institutions, but free reference had been made in this case to a particular trade name. If the name of Permutit was not taken out of the paper before the final publication, then it seemed to him that the trade names of other water softening materials should be added to it, such as the Page Jones, de Wayne, and other firms, which put the same material on the market under their own particular trade names. An interesting feature of base-exchange water softening had recently come into prominence, and that was softening upwards. It had been found by some experimenters that softening upwards had an advantage over softening downwards. With regard to the point raised by Dr. Olsen as to the alkali in the treated water, he believed that could be overcome by two methods. Water very high in calcium or magnesium or carbonate could be treated with lime, and then, if necessary, reduced to the so-called zero hardness by the base-exchange water softener; or, if the purpose for which the water was required would allow, the sodium or carbonate could be neutralised with an acid. He knew that some people thought that rather dangerous, but at the University of Illinois, where there was a high calcium-magnesium-carbonate water, acid had been applied for a number of years with great success, preventing any trouble in the boilers from the concentration of the alkali which, prior to the use of the acid, used to cause cracking of the boiler plates and heads.

The Author's Reply

Mr. O'CALLAGHAN, in replying, said that if a water high in carbonates was being treated for boiler feed purposes, it could be very efficiently dealt with. There were a large number of plants in this country in which preliminary lime treatment, which was very cheap, was adopted for the reduction of the carbonates, and for reducing the hardness from, say, 20 deg. to 5 deg. Then the base-exchange treatment was applied for the elimination of the remaining degrees of hardness, furnishing a water which was not very alkaline

and which was very soft. The experiments made on this side had shown upward filtration to be rather dangerous.

Mr. W. LAURIE STEVENSON read a paper on "The State *versus* Industry; or the State with Industry."

Other papers presented were: "Statutory Regulation of Stream Pollution and the Common Law," by E. B. Besselievre; "Recent Experience of Doucil in Water Softening," by T. P. Hilditch, D.Sc., F.I.C.; "The Absorption of Hydrochloric Acid and Some Data Regarding the Tyler-Vitreosil System," by S. L. Tyler; and "Pioneer Studies by the Bureau of Chemistry on Pollution of Shellfish Areas," by J. W. Sale.

Sir ARTHUR DUCKHAM, in closing the meeting, said that with regard to effluents from works, he hoped that experiments would be carried out in the near future in an attempt to get rid of them by evaporation, either in the heat pump process or the recompression process.

Annual Dinner of the Society

THE annual dinner was held at the Town Hall, Leeds, on Thursday, July 16, a company of some 300 attending, and the chair was taken by Mr. W. J. U. Woolcock, the President.

Proposing "The Society of Chemical Industry," Mr. THOMAS HARGREAVES referred to the world-wide character and influence of the Society of Chemical Industry and the manner in which it had helped the industries of the country. It was quite obvious that when we got into the difficult markets of the world and had to compete with other nations, we had to depend upon chemists and chemical engineers for guidance. Coupling the name of the President with the toast, he spoke of the work Mr. Woolcock had done in connection with the British Empire Exhibition.

The PRESIDENT, replying, said that the function of the Society, above all other things, was to secure co-operation between the industrialist and the scientist. One extraordinary effort in co-operation had taken place this year. Abstracts of chemical literature had hitherto been published separately by the Chemical Society and the Society of Chemical Industry, but these two societies had recently been able to agree that from January 1 of this year there would be produced one set of abstracts. He wished to pay a tribute to those members of the Chemical Society who had enabled that great step in regard to the publication of scientific literature in Great Britain to be brought about. The result would be that a more complete series of abstracts could be prepared at the same cost and each member of each Society would be presented with an index to all the chemical literature published in England. Perhaps before long it would be possible, by co-operation with American chemists, to arrange for the publication, in one form, of all the chemical literature printed in the English language.

American Co-operation

Mr. WALTER REID then proposed the toast of "The Guests," which was replied to by Dr. C. L. REESE, President of the American Institute of Chemical Engineers, who expressed the thanks of the American visitors at the hospitality they were receiving. Speaking of the visits to the works of the British Dyestuffs Corporation and of other companies, he said that they had been taken through the works and shown everything freely, and he could promise that if British chemists would visit America in the near future they would be given the same free access to inspect all that was being done out there. With regard to chemical abstracts, mentioned by Mr. Woolcock, he believed he could say on behalf of American chemists and chemical engineers—although he was speaking on his own behalf at the moment—that they would welcome a publication of abstracts of all the chemical literature published in the English language. He suggested that their *Journal of Physical Chemistry* should be the medium for this publication and hoped something would be done to bring this about, because it would cost a great deal less than at present and the work could be done more efficiently.

The remaining toasts were "The City of Leeds," proposed by the President and replied to by the Lord Mayor of Leeds; "The University of Leeds," proposed by Dr. E. F. Armstrong, and replied to by the Vice-Chancellor; and "The Hon. Secretary of the Yorkshire Section and the Editor of the Handbook," proposed by the President, and replied to by Professor N. M. Comber and Mr. H. J. Hodsman.

Visit to the B.D.C. Works

After the luncheon at which the Society was entertained by the British Dyestuffs Corporation, members travelled by a special train to Huddersfield, where tramcars were waiting to take them to the company's works at Dalton. Many interesting processes were shown to the visitors, who were conducted round the works in small parties, but as the area covered by buildings is about 21 acres, it was impossible to see more than some of the essential operations of dyestuffs manufacture during the afternoon. Dr. E. F. Armstrong and Mr. C. J. Cronshaw were responsible for the admirable arrangements and took an active part in showing the exhibits to visitors.

The B.D.C. operations cover the whole ground of dyestuff manufacture, starting from sulphur in pyrites, nitric in sodium nitrate, hydrochloric in salt, chlorine as such, and benzol, toluene, etc., in crude naphtha. The acid plants consist of chamber and contact plants, a valentiner nitric acid plant, and salt cake furnaces for hydrochloric manufacture. The chemical control of all raw materials, intermediates and finished products is undertaken by the analytical laboratory, where a few of the methods employed to examine the dyes tinctorially in the company's central dyehouse at Blackley were shown. This exhibit was arranged specially for this visit and illustrated the careful and elaborate testing of products that had to be done, even after they are passed by the works, before they are sentenced as fit for issue. The Corporation has made research a corner-stone in its organisation and a research block was visited, where an attempt was made in the various laboratories and small scale experimental plant to show the complexity of the field covered by the dyestuffs industry, not only as to diversity of products but also as to range and conditions of temperature and pressure under which the operations are performed. So great is this diversity that the only plant connected with actual dyestuffs production which can be reduced to standard mass production units is the azo plant. Apart from this, each individual product has usually to have its individual plant.

Research Laboratories

The Corporation has research laboratories at each of its factories, and the laboratory at the Dalton Works is also equipped with an experimental plant. The number of fully qualified chemists employed exclusively on research work is 50, and the total personnel of the research laboratories amounts to 137. The work done in the research laboratories covers, broadly, (1) the evolution of efficient processes applicable to the conditions of bulk production in the factory from reactions which have been disclosed already in chemical literature as purely laboratory methods; (2) the elucidation and provision of remedies for defects in existing manufacturing processes on the score of efficiency or of quality; (3) constant search for improvement in the efficiency of established processes, and (4) search for new methods and for new products which have not hitherto appeared on the market. Exhibits were arranged in some of the laboratories to illustrate the nature of the work carried out, and the complexity of the processes involved in the manufacture of dyes. A marked feature of the exhibits was the demonstration of a great number of distinct chemical operations involved in the manufacture of even the cheapest and most commonly used dyestuff. A common direct cotton blue, for example, involved as many as 37 distinct plant operations. In the central analytical laboratory about 25,000 samples are examined annually, comprising the whole of the chemical raw products used by the corporation, and such supplies as coal, water, etc., together with samples supplied by manufacturing departments for analytical control during the different stages of manufacture. In addition, dyestuffs intended for food colouring purposes are subject to a rigorous control, whilst chemical products other than dyestuffs, such as intermediates, sulphonated oils, rubber accelerators, etc., have also to conform to strict analytical tests before sale.

Azo Colours

Azo colours are made by the combination of a diazo body produced by action of nitrous acid on an aromatic amine, with another amine, phenol, or derivatives of these, usually sulphonic acid. They constitute by far the largest group of synthetic dyestuffs and many hundreds of colours are manufactured by this reaction by varying the first or second com-

ponents of the coupling. In one of the sheds visited some forty to fifty different colours were being manufactured, first in order of quantity and importance being blacks, followed by blues, reds, yellows, greens and browns. Both acid wool and direct cotton colours, and to a smaller extent basic dyes, are made by the azo reaction. The plant unit required consists of three vats, increasing in size from top to bottom, with a pump, press, and a drying stove. The amine to be diazotised is dissolved in one of the vats and there treated in the presence of mineral acid with sodium nitrite at a suitable temperature whereby the diazonium compound is formed. This is run into the second component dissolved in another vat when colour formation takes place. This is often very rapid, but in some cases the combination requires several days before completion. The dyestuff, if soluble, is thrown out of solution by the addition of salt, which is added down chutes from trucks in the top stage of the shed. The suspension of colour is then pumped through the filter press and the paste colour emptied by manual labour into the boxes beneath each press. Thence it is loaded into trays and dried in the stoves. The colour has then to be ground and standardised to extract colour strength and shade before it is ready for issue.

An American Tribute

Speaking in the tea-room in which refreshments were served, Dr. Charles Reese, the President of the American Institute of Chemical Engineers, and a director of the Du Pont Co., U.S.A., said that he wished to thank the British Dyestuffs Corporation for the luncheon served at Leeds and the arrangements made at the works. The visitors had been allowed to inspect the plant and had been shown processes which had been considered to be secret, and he suggested that the members should go home and talk about this wonderful dye industry which had been organised in Britain. They did not want foreigners to come in and destroy the industry, and it was up to the British to prevent it. The dye industry was established in Britain, and it was going to stay. He was deeply impressed by the display of dyes which he had seen at the Corporation's works, and by the accelerators for rubber and the wonderful developments in that direction, particularly by the picture in rubber which was on view. It gave him much pleasure to tender thanks to Dr. Armstrong and the directors on behalf of both the American and British visitors.

American Chemical Engineers at Nobel's

THE American Institute of Chemical Engineers, accompanied by members of the British Institution of Chemical Engineers, visited the Ardeer Factory of Nobel's Explosives Co., Ltd., on Saturday, July 18. In the absence of Sir Harry McGowan, chairman of the company, the directorate was represented by Sir Ralph Anstruther, vice-chairman.

During a tour of the factory, which covers an area of 1,000 acres, the visitors were shown the most modern plant used in the production of sulphuric and nitric acids, commercial blasting explosives, propellants, distress and sound signals, etc. A visit was also paid to the testing station, and the apparatus used for controlling manufacture and for research work on explosion phenomena was inspected. It was shown that although charges of the order of 2 oz. of some explosives could ignite inflammable mixtures of coal gas and air, and coal dust and air, explosives are designed to-day which would not ignite these mixtures with charges of over 1 lb. under normal gallery conditions. Demonstrations of the practical application of explosives is a difficult problem inside an explosives factory, nevertheless some interesting experiments were carried out to illustrate how explosives can be used to facilitate operations and reduce expenditure.

Sir Ralph Anstruther, speaking at a luncheon to the visitors, cordially welcomed both the societies to Ardeer, and proposed the toast of the American Institute of Chemical Engineers. The company, he said, was gratified that their largest factory should have been chosen as one of those to be visited. Dr. C. L. Reese, in responding, said that they much appreciated the warm welcome they had received. They had been greatly impressed by the organisation of the factory, and their visit had been of much educational value. Professor J. W. Hinchley, on behalf of the British Institution, thanked the company for the facilities given them for inspecting the factory.

Alleged Water Pollution

Injunction Against the Clayton Aniline Co.

IN the Chancery Court at Manchester on Wednesday, Mr. Courthope Wilson, K.C., gave judgment in an action brought by Thomas Murdoch, trading as Walton and Murdoch, Medlock Vale Bleachworks, near Clayton Bridge, against the Clayton Aniline Company, Ltd., colour manufacturers at Clayton, for an injunction to prevent pollution of the Lumb Brook at Droylsden.

Mr. Wilson said that on October 15, 1921, the defendants completed the purchase of 6½ acres of land near Droylsden station. They promised to take every precaution to prevent pollution of the stream. The siding was completed in May, 1922, and since then 75,000 tons had been tipped. From October, 1922, to November, 1924, in addition to cinders, coloured refuse was deposited in large quantities, and the effluent from the foot of the tip which ran into the Lumb Brook was deeply coloured. Instructions were issued by the defendants as to what should be tipped and what should not, but they were not always carried out.

The main effort of the defence had been to show that at the point where the water of the stream entered the plaintiff's works the stream had been cleaned by natural forces, so that plaintiff's water was not altered for the worse; and it was admitted by the plaintiff's experts that samples taken at the intake into his works would not reveal to the eye or by chemical analysis any sensible alterations compared with the water above the point of junction with the tip effluent. But it seemed to him this was a case where a sensible alteration in the quality of the water might be disclosed in its industrial use, although not apparent on a meticulous examination made under laboratory conditions. He had come to the conclusion that stains which had occurred in the bleaching processes were due to colouring matter proceeding from the tip, and there would be an injunction. The plaintiff had not claimed any special damage, and he would be awarded 40s. as general damages. The defendants must pay the costs of the action. It was not an engineering impossibility to prevent the effluent entering the stream, and the operation of the injunction would be suspended for three months on the defendants' undertaking to indemnify the plaintiff, to such an extent and in such manner as the Court might direct, for any loss he sustained by the delay. For previous hearings, see THE CHEMICAL AGE, May 30, June 6, July 4 and 18.

British Engineering Standards Association

THE British Engineering Standards Association held its seventh annual general meeting on Thursday, July 9, at the Institution of Mechanical Engineers. The Chairman, in his review of the year's work, was able to strike a more hopeful note than this time last year, both as to organisation and as to finance. The balance sheet showed that the deficit carried forward from the previous year had been reduced from over £1,900 to £677. He regretted, however, that, owing to there being at the present time no further funds for the purpose, the valuable work of translating the British Standard Specifications into foreign languages and disseminating them abroad had had to cease. A new scheme was, however, to be put into operation in the autumn by which the main committee was hoping to obtain the support of professional engineers, individual firms, and business men connected with all the great industries of the country, through the reorganisation of the Association's membership. The members, who will be admitted at a minimum annual subscription of two guineas, will have certain privileges, including direct representation on the main committee itself. The present contributors are in the meantime being consulted on the new scheme and invited to join without further fee and to maintain their present contributions, thus enabling the B.E.S.A. to enlarge its scope and at the same time to make its work effective throughout the world.

In reference to the scheme for enlarging the membership, the Prime Minister has addressed a letter to the Chairman expressing the hope that the Association will be successful in the effort now being made to obtain much wider support for the Association's activities, which he feels sure will contribute materially to maintaining and improving the efficiency of our national industries.

Canadian Electro-chemical and Metallurgical Industries

By L. E. Westman*

UNLESS an electro-chemical or electro-metallurgical industry is well established and supplied with power before the demand exceeds the supply, it is not in a good position to compete thereafter, especially when the cost of power is a major factor. As in other lines, but to a much greater extent, the products of electro-metallurgical works are exported, and the Canadian market for cyanamid, ferro-alloys, abrasives, acetic acid, zinc, aluminium and synthetic nitrogen is not at present great. Looking broadly at the situation of the moment, the chief centre of interest appears to exist in the Province of Quebec. As further power is developed in British Columbia, Manitoba, and Ontario, these industries may use their share. While there are notable general developments elsewhere, the past two or three years have been, and the present still is, a critical period in the power situation in Quebec and on the St. Lawrence; and, as developments discussed and proposed take place, there should result a considerable increase shortly in the output of electro-chemical and electro-metallurgical industries.

Sodium Sulphide by the Electric-Furnace

Although it is not a matter of great moment as yet, from the standpoint of power consumption, the recent production of 90 per cent. sodium sulphide by electric furnace methods, at Shawinigan Falls, is a distinct Canadian contribution to industrial electro-metallurgy. The credit for this advance goes to Horace Freeman. The process is now well worked out, and the new product has been marketed to the satisfaction of the trade. It is impossible to pass this piece of brilliant research without further comment. Here is a product never made in Canada before by any process, and, as a result of research, a Canadian chemist makes a distinct advance, and in short, revolutionises the method of production. The Government, however, gives no protection against imports from European countries, where a poorer product is made by less efficient methods, and, because of depreciated exchange, is sold in Canada at a price which makes it impossible for a Canadian company to operate. If all the Canadian market were available, manufacture would be possible. Following this logic, it remains for Canadians to carry on research, and sell their ideas to German and American companies, which, because of depreciated currency on the one hand and protection on the other, can manufacture and sell the product back to the country which gave them the idea. Unless the Government and the people as a whole awake to the deadening influences of the application of this principle in general, Canada, strong as she is in youth and natural resources, will be robbed of her birthright and crippled in the years to come. As long as our system of adding and removing duties is on the present unscientific basis, no industry that demands a knowledge of the scientific method is safe in Canada. Possibly no other country in the world, at the present moment, is handling questions of this kind and its general industrial development with as little regard for world-wide conditions and scientific economics. We are still in the stage where party cabinet ministers settle such matters in a few minutes' conversation, and without any better guide than a general policy of leaving things as they are. It is unfair to the elected representative and the country that a member of the Government should be asked to sit in judgment on a technical matter regarding which he can only have the opinion of a layman.

Important Electro-metallurgical Developments

Returning to the situation in Quebec: Power capacity has increased by the development in the north-eastern part of the Province. The pulp and paper industry continues to increase its demands; but it is not impossible to see a time, a very few years hence, when the peak of power consumption in this industry will be reached. Those who have studied this point place the maximum within five or ten years. This would indicate that electro-metallurgical industries might be better power consumers, over a long period, than pulp and paper mills. There exists the great Shawinigan group at Shawinigan Falls, and the plant of the Northern Aluminium Company. It seems fairly certain that a second aluminium works will be erected in Quebec in the near future.

There has been much talk of a zinc plant in the St. Lawrence.

This is a long way from an assured works, but, if ores and processes of treating them are both developed in a satisfactory manner, this is an interesting possibility. Some of the best work so far accomplished by the Bureau of Mines Ore Dressing Division, has a relation to possible developments in this province. The staff who are engaged on this work are to be congratulated on the results accomplished so far.

A Specific Problem

Given an ore containing gold, copper, iron, and sulphur, is there any way of recovering all values, including sulphur? It is apparent that the Province of Quebec has in one district alone—Rouyn—a specific problem, one solution of which has been outlined as follows: Ship concentrates to tide-water at Quebec, and avoid smelting operations in a district which would be, to a large extent, ruined for agricultural purposes. It is understood that the Quebec Government does not wish to give over the Rouyn field to smelting operations, and that it has stated that a location 25 miles north-east, in a rocky district, would be much more desirable. If this is carried through, it would be cheaper to ship concentrates to Quebec City than to ship them to the proposed smelter, and reship the products to Quebec. Other factors would favour smelting operations on tide-water.

The Ore Dressing Laboratory is working on two processes, one of which is the so-called "Eustis Process." This work is encouraging, at least, and is well advanced. Both methods involve recovery of iron, sulphur, copper, and gold. By the Eustis process, the ore is heated in a closed vessel, removing some sulphur, and dissolved in ferric chloride, with separation of sulphur. The solution is freed from zinc, and the copper precipitated with iron scrap. Then follows electrolysis for the production of iron, and the anode overflow used for further extraction. The gold and sulphur is recovered from the residues from ferric-chloride treatment.

By the second method, the crude ore is smelted in a reverberatory furnace with a lime flux to remove silica, and the low-grade matter obtained is treated at 1,400° F., in a MacDougall furnace, and by the Hall process of desulphurisation. There are difficulties, of course, in the experimental work, and in design of commercial units; but there is an objective worth while, and, if Canada can produce her own sulphur, and at the same time use her power and her gold-sulphur ores, the game is worth all the research that is likely to be undertaken by the Government.

The copper ores of the Eastern townships and the zinc and lead ores of Gaspe all offer electro-metallurgical and electro-chemical opportunities, which line up with the power situation of this province.

Nitrogen Fixation

A word on the national situation on nitrogen fixation. It seems clear that cheap power is passing out as the important factor. The arc process on a large scale is not destined to play the part that it did at one time. The Claude or Haber process is being adopted in all new developments, and the competition is rather between electrolytic hydrogen and hydrogen from coke-oven gas, as far as Canada is concerned. For a Canadian plant to compete, using electrolytic hydrogen, the power cost would need to be very cheap. The only serious though small scale effort to operate the arc process at the present time in Canada is being put forward at an Ontario plant. The power conditions are of a special nature and the object is the production of nitric acid in a small way. This should not be confused with the general question of large scale production of competitive fertiliser materials containing nitrogen. The operation of this plant will demonstrate the commercial efficiency of this type of rotating arc.

The situation, then, would seem to indicate that, as far as Canada is concerned, the development of her electro-chemical and electro-metallurgical industries will be along the lines of those now established, namely, the production of metals and electric-furnace products, and that the best developments to follow are those pieces of research which will permit us to use our own ores or those that may be imported. In no instance is there any national benefit arising from the export of electric power.

* From "Canadian Chemistry and Metallurgy."

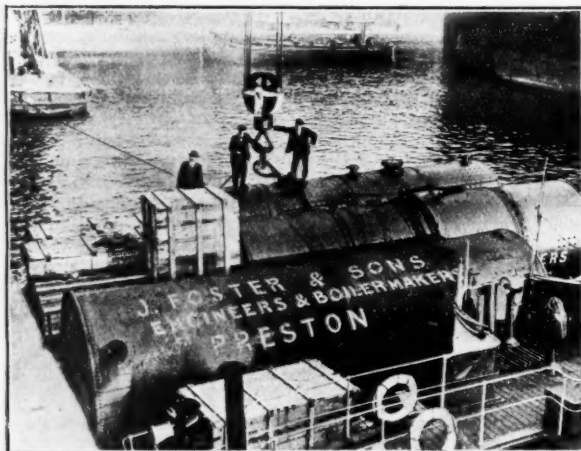


THE FACTORY AT CORNWALL, ONTARIO.

Courtaulds' Canadian Enterprise

Artificial Silk Factory at Cornwall, Ontario

COURTAULDS', Ltd., of London and Coventry, have recently demonstrated their progressive policy by the erection of a large six-storied artificial silk factory at Cornwall, Ontario. This factory is to work as a self-contained unit, and when fully equipped and producing at its maximum capacity, so the owners state, it will be "capable of satisfying the major portion of the present Canadian demand." The first actual production was started in May of this year. A photograph of the factory, when nearing completion last winter, is shown herewith.



LOADING LANCASHIRE BOILERS FOR COURTAULDS' CANADIAN ARTIFICIAL SILK FACTORY.

An interesting item in the equipment of the factory is also shown—a battery of four Lancashire boilers supplied by Joseph Foster and Sons, of Soho Foundry, Preston, who are makers of plant for many leading chemical concerns. These boilers are 30 ft. long by 8 ft. diameter for a working pressure of 200 lb. per sq. in.

Medan Palm Oil Production Increasing

THE Department of Overseas Trade has received the following extract from the *Journal of the Medan Chamber of Commerce* in regard to the cultivation of palm oil:—

"The great expansions of the cultivation of palm oil that have been announced or already begun make it certain that our exports will again notably increase in a few years' time. The areas planted were at the end of 1915, 3,130 hectares; 1920, 9,078 hectares; 1923, 15,395 hectares; 1924, 18,945 hectares.

"Areas of about 15,000 hectares will be in full bearing in 1934 and should yield about 30,000 tons, making the total production at least 70,000 tons without reckoning expansions made in 1925 and subsequent years."

Canada's Mineral Production

Satisfactory Progress and Good Possibilities

A PRELIMINARY Report on the Mineral Production of Canada during last year has been issued by the Dominion Bureau of Statistics at Ottawa. Canada's mineral industry last year yielded products valued in the aggregate at 209,516,465 dollars, a total which has only been exceeded in three previous years: in 1923, when the output was valued at 214,079,331 dollars; in 1920, when the peak of 227,859,665 dollars was reached; and in 1918, when the total value of 211,301,897 dollars was recorded. Most of the non-metals showed only slight reductions from the totals for 1923, and one or two, notably gypsum and natural gas, showed improved figures.

Nickel and Copper

Two companies produced nickel-copper ores throughout the year, and operated their smelters in the Sudbury area; a third company was forced into liquidation in July, and operations at their mine, smelter, and refinery were discontinued. In spite of this loss the output of nickel determined as the nickel content of matte made in the Sudbury smelters, together with small quantities contained in South Ontario smelter residues exported, advanced 7.13 million pounds to 69,586,759 pounds, which, valued at the average New York market price of 28 cents for refined nickel, would be worth 19,484,292 dollars.

Progress in the production of lead at Trail continued unimpeded during the year, and the new high record established in 1923 yielded place to the 1924 output. The total lead produced from Canadian ores in 1924 was 177,756,076 pounds. Zinc production reached a new level of 98,788,667 pounds, including 54.88 million pounds refined at Trail and 43.90 million pounds estimated as recoverable from concentrates exported to Belgium and the United States.

Cobalt

Sales of cobalt and its products in the form of metal, oxide, and salts, and in residues exported comprised 960,266 pounds of contained metal, for which the producers received 1,678,124 dollars. In the asbestos industry shipments were somewhat less than in 1923, amounting in all to 220,005 tons, valued at 6,590,251 dollars.

Natural Gas

The production of natural gas showed a slight gain both in quantity and value, sales reaching a total of 6,178,435 dollars, as compared with 5,884,618 dollars in 1923. Progress in the gypsum industry, noted in 1923, continued throughout 1924, and sales increased in quantity to a total of 645,020 tons; lowered unit values, however, reduced the aggregate value of sales to 2,198,598 dollars. The quantity of salt sold was greater in 1924 than in the preceding year, but the reported value of sales was slightly less. Cement sales, while about equal to 1923, dropped to 1.63 million dollars in value to 13,445,156 dollars; lime sales were a quarter of a million dollars lower at 3,062,450 dollars; clay products sales totalled 8,627,572 dollars, as against 10,483,016 dollars in 1923.

The outlook for the mineral industry in Canada must be considered encouraging in spite of the decline in the total value of the output for the year. Prosperity in the metal mining field gives promise of much greater activity in the immediate future.

British West African Markets

Their Needs and Possibilities for British Producers

If the capacity of a market to absorb imports could be measured merely by the number of its inhabitants, British West Africa would rank high among the world's trading areas. The population of Nigeria is nearly 19,000,000—larger than that of any British dependency except India; of the Gold Coast Colony, Ashanti, and the Northern Territories it is over 2,000,000, and of Sierra Leone and its Protectorate between 1,000,000 and 1,500,000. But although population alone does not mean purchasing power, ample evidence is forthcoming of the sure and steady growth of the buying capacity of the West African.

The annual value of Nigeria's imports is over £10,000,000, or five times what it was twenty years ago; during the last two decades exports have increased four times in value, according to *The Times Trade and Engineering Supplement*. In the first half of 1924 the value of imports was £5,882,000, £4,240,000 being the share of the United Kingdom. About two-thirds of the Nigerian imports are derived from the United Kingdom, but the proportion shows signs of diminution owing to the larger shares of Germany, the United States, and Holland. The chief commodities supplied by Germany include mineral waters, cement, earthenware, enamelware, glassware, cutlery, brass, iron and steel goods, and medicines. The main exports from the United States to Nigeria are flour, illuminating oil, petrol, motor vehicles, and sugar. France has been improving her position as a supplier of mineral waters.

Goods which have a ready sale in all parts of the country include soap, salt, kerosene, matches, and in the larger centres there is a demand for candles and tarpaulins.

Sales Organisation and Extending Trade

There are men of experience in the trade who are well versed in the methods of bringing suitable British manufactures within the reach of the greatest possible number of customers amongst the large native population. It has been suggested that not the least effective method is that of enlisting the assistance of the African himself. The sale of British goods is spread throughout the whole of British West Africa by means of small stores in the towns and villages. These are frequently branches of the concerns at the ports and are usually managed by Africans under European supervision. The African storekeeper is paid a commission on sales. It is through the African trader that great opportunities exist for extended trade, but references as to his reliability should first be obtained. In this connexion the Chambers of Commerce of Accra, Cape Coast, Kumasi, Quittah, Sekondi, and Winnebah in the Gold Coast; at Lagos, Calabar, Port Harcourt, and Kano in Nigeria; and at Freetown in Sierra Leone would probably assist.

Another method of doing business is by consignments of goods through the banking houses, whilst yet another, as already mentioned, is through the Parcel Post.

The authorities of the British West African colonies take great pains in placing all possible information regarding the territories' import requirements at the disposal of British firms. Included in their exhibits at Wembley this year will be the reproduction of a native shop where exporters desirous of obtaining their share of the ever-increasing outlets for manufactures will be able to see exactly what the native is purchasing.

Good Paint Market

Amongst the drugs and disinfectants widely sold are iodide of potassium and iodoform, and quinine has a large sale.

There is a growing trade in paints, the largest proportion being imported in dry form; oil paints, polishes, and varnishes also enter, as well as a small quantity of turpentine and turpentine substitutes.

With regard to packing generally it should be remembered that transport is difficult. Strong tins or sound cases are essential. Tin linings or waterproof packing are necessary for all goods that may be affected by water.

Phosphate Deposits at Cape Town

REPORTS from Cape Town record the discovery of extensive deposits of phosphates within twenty-five miles of Cape Town. The deposits are said to cover an area of about seven miles square and to contain approximately 7,000,000 tons of phosphates.

Czechoslovakia's Chemical Resources

Glass Industry Flourishing and British Imports Increase

The Department of Overseas Trade has published a report on the general conditions in Czechoslovakia at the present time, and the information includes valuable details of chemical progress.

The glass industry appears to be progressing. Exports for 1924 recorded an improvement of 30 per cent. over 1923, and the U.K. was the second largest market, taking a value of Kc 198 million. Hollow glass accounted for over 40 per cent. of that figure. The bottle industry has revived, but German competition is keen. Sheet glass factories are badly hit, but the chemical glass industry is satisfactory, and exports to England were relatively large in 1924.

Metallurgical Industries

Ten blast furnaces were in operation during 1924 on an average, out of a total of 27. At present 11 blast furnaces are working.

During 1924 Belgian and Saar foundries were underselling Czechoslovak products, and in the second half of the year, when a fall in prices occurred on the world's markets, Czechoslovak exports were sold below the cost of production. The scope of the Czechoslovak iron cartel was extended during 1924 as a result of the Freistadt, Hradek, and Libschitz ironworks being taken over by larger firms belonging to the cartel. There is only one independent ironworks of importance remaining. Negotiations are also in progress with works in other countries with a view to their joining the Central European cartel, and if these are successful it is not unlikely that the existing arrangements with the German iron industry will be extended, the more so as German competition is again being felt, especially in the South-Eastern markets of Europe. Costs of production must be lowered before the iron and steel production can reach its maximum.

The sugar industry is rapidly reaching pre-war production figures, and last year Great Britain was the chief market, with imports equalling over 30 per cent. of the production.

In a supplementary report on Slovakia reference is made to the successful formation of a syndicate of distillers and refiners, and "dynakol," a benzol-alcohol substitute for petrol, is mentioned. A sales combine has been created in the fertiliser industry. The price of 1 per cent. phosphoric acid fell from Kr. 7.50 in the autumn of 1922 to Kr. 3.03 in the spring of 1923. It rose then to Kr. 3.33, but the tendency has been downwards. There is no import duty on superphosphate. There is a 100 per cent. duty on sulphuric acid, which, with one exception, is not produced by the Slovakian factories. Superphosphate contains 60 per cent. of sulphuric acid, which costs here £3 per ton as compared with £1 in the open market. The foreign manufacturer imports the 60 per cent. of the sulphuric acid contained in the superphosphate free of duty, whereas the local manufacturer has to pay the enhanced price on sulphuric acid due to that duty. The production of superphosphates in the Republic during the first six months of 1924 was 100,000 tons, and during the second six months 85,000 tons were produced. The bone flour industry was started in Bohemia to provide a bleaching material for the sugar factories. When a better substitute was found bones were worked up into grease, glue, and fertilisers. There are two such factories in Slovakia which, owing to a tariff protection, have done well in 1924.

The report states the British trade with Czechoslovakia is hampered at present by high tariffs and restrictions, but there are possibilities of valuable expansion.

Handling Corrosive Chemicals

THE manufacture, conveyance, and storage of corrosive chemicals call for the use of special fittings, and in that connection the latest catalogue of ebonite fittings for the chemical trade is of interest. This list is published by the Hightensite and Ebonite Manufacturing Co., Ltd., Normandy Works, Custom House, London, E.16. Ebonite can now be moulded into any desired shape and ebonite pumps are a line featured by this firm. A specialised process of manufacture has enabled the production of a special lining for metal tanks for the conveyance of acid by road. The lining is so designed as to obviate the possibility of cracking through vibration, and this means of transport is stated to afford distinct advantages over the carboy system of cartage.

Developments in the Nickel Industry

MR. J. L. AGNEW, President of the International Nickel Co., recently addressed members of the Toronto Section of the Canadian Institute of Mining and Metallurgy on "Developments in the Nickel Industry." He reviewed the early days of production when difficulties in nickel recovery were great, and when the alloy properties of nickel were not developed or understood. In some ways, it had been unfortunate that the first big use for nickel had been in the development of armaments. This formerly gave an outlet for 60 per cent. of the nickel produced. This business went out, following the war, and left a very difficult situation, which was reflected in nickel production. In 1895, which was the first fairly accurate record, some twenty-five hundred tons of nickel were produced. By 1913, this had gone up to twenty-seven thousand tons, and, in 1918, reached forty-six thousand tons. The year 1920 was faced with a possible peace market of about eighteen to twenty thousand tons, and a production and refining capacity of about three times this amount. Ore reserves were very liberal, and, without counting on the very strong likelihood that much ore existed that had not been surveyed, because it did not outcrop, there was enough, at this rate, to run the world demand for 150-175 years. With large quantities of ore, and an over-supply of plant, the problem was to produce a market. This market had already been produced in large part, and the story was one of the most remarkable of its kind to date.

The Field for Nickel Products

One of the first moves was to increase the rolling-mill capacity so that nickel could be made by the nickel companies into the products that could be sold. Some of the industries that have greatly expanded the business were: automotive—taking 20 per cent. of the metal, steam engineering, dairy, food products; textile and laundry machinery; hotel, restaurants and soda-water fountain equipment, radio, and dyeing plants. The anode business had grown, and the very large possible railway field was being thoroughly exploited. This had been the result of definite surveys and selling plans. The competition had been with other metals, such as vanadium, chromium, tungsten, manganese, and molybdenum.

One big use which had been developed relatively more widely in Canada than elsewhere was the introduction of a certain amount of nickel in cast-iron. Piston-rings, for example, made in this way showed quite improved properties and length of life. The nickel was produced with from 4 per cent. to 6 per cent. silica content, which made it possible to use it with iron, by lowering the melting-point. Already, the industry, as far as production was concerned, had overcome the loss of the armament business; and it was not impossible to believe that the new developments would consume more nickel, in a reasonable time, than even the peak of war production.

Chemical Corporation's Capital Reduction

In the Chancery Division, on Monday, Mr. Justice Eve confirmed a reduction of capital of the Chemical and Metallurgical Corporation, Ltd.

Mr. Uthwatt, for the company, said that it was proposed to write off 19s. on each of the ordinary shares.

His Lordship: £950,000 altogether; nearly a million of money lost since 1917.

Counsel said the capital was £1,200,000, consisting of 200,000 cumulative preference shares and 1,000,000 ordinary shares, issued in consideration of certain patents.

His Lordship: It is a vendor's loss really.

Counsel: Yes, it goes further, because the vendor was entitled under the sale contract to £30,000 after the dividend had been paid on the preference shares, and that is also being released. The whole reduction was part of a scheme for the purpose of raising further capital to enable the company to use their patents. The preference shares were not touched and over 60 per cent. of the shareholders were represented at the meetings and approved the scheme. The existing £1 shares were to become 500,000 shares of 2s. each, taken at par value. The vendor or his nominees held 329,000 of the shares. The bulk of the reduction was with respect to the patent rights, which appeared in the balance-sheet as valued at £1,222,000, and it was impossible to say now what was the real value of these assets.

Chemical Matters in Parliament

Germol Disinfectant Company

Mr. Short (House of Commons, July 15) asked the Minister of Labour whether he was aware that the Germol Disinfectant Company recently secured employes through the Wednesbury Employment Exchange, and dismissed such employes and failed to pay them the rates agreed upon by the Exchange and the company.

Sir A. Steel-Maitland said that he would have inquiries made.

Chemical Manufacturers' Refuse

Mr. Short (House of Commons, July 16) asked the Minister of Health whether he was aware that Chance and Hunt, chemical manufacturers, Wednesbury, deposited chemical refuse on a tip near their works; that the tip was open to the public, and that certain children had suffered injury by being burnt about the feet; and would he exercise his powers to arrange for the tip to be fenced.

Mr. N. Chamberlain said that he was informed that this refuse was tipped on private land, and that there was no danger to anyone unless he was trespassing. He had no authority to direct that the tip be fenced, and it seemed doubtful whether it would be reasonable to expect this to be done, but he was communicating with the Town Council on the subject.

Tar Workers' Ulceration

Colonel Day (House of Commons, July 20) asked the Home Secretary whether his attention had been drawn to the prevalence of epitheliomatous ulceration amongst tar workers; and whether it was intended to extend regulations providing wash and bath accommodation for the benefit of all those employed on or about tar distillery works.

Sir W. Joynson-Hicks said that this disease among tar and pitch workers was made notifiable to the factory inspectors some years ago, and the figures of cases reported were given in the chief inspector's annual reports. Regulations were already in force requiring the provision of washing and bath accommodation at the distillery works.

Wood Pulp Trade

Mr. Livingstone (House of Commons, July 21) asked the President of the Board of Trade what were last year's imports into this country of mechanical and chemical wood-pulp, respectively, and also the exports of both from this country?

Sir P. Cunliffe-Lister gave the following figures showing the quantity and value of wood-pulp imported into and exported from Great Britain and Northern Ireland during the year 1924:—

Description of wood pulp.	Quantity.	Declared value thereof.
(a) Imports:	Tons.	£
Chemical	473,880	6,261,867
Mechanical	752,594	3,595,434
(b) Exports—produce of Great Britain and Northern Ireland:		
Pulp of wood	10	262
(c) Exports of Imported Produce:		
Chemical	3,129	43,757
Mechanical	3	14

Superphosphate Inquiry Results

Sir P. Cunliffe-Lister (House of Commons, July 21), in reply to Captain Wedgwood Benn, said that he was not in a position to make any statement on the subject of the Report of the Committee of Inquiry on superphosphate.

Sulphate of Ammonia Market in Java

SULPHATE of ammonia is the principal fertiliser used on the cane lands in Java, and is imported from several countries. Figures show that the demand for sulphate of ammonia in that island is increasing and that Great Britain is now the principal supplier. India is also improving its position as a supplier, as will be seen from the steadily rising figures of imports therefrom.

In North Bihar the Sugar Bureau took steps to introduce sulphate of ammonia last year, and already there are indications that large cane growers have begun to appreciate its use as a manure.

From Week to Week

THE SALE OF THE ALSACE POTASH MINES to the State has been completed and a price of 208 million francs agreed.

NEGOTIATIONS FOR A COMPLETE FUSION of the German aniline industry will be resumed in the first week in August.

THE OLDEST EMPLOYEE at the chemical works of Brunner, Mond and Co., Ltd., Mr. Robert Slade, aged 82, is "doing" Wembley and London for his holidays.

PROFESSOR WEMYSS ANDERSON has retired from the position of Dean of the Engineering Faculty at Liverpool University. He is an authority on refrigeration and has designed and erected cold storage plants and ice factories.

THE INDIA RUBBER MANUFACTURERS' ASSOCIATION, LTD., has issued a protest against the present restrictions of exports of crude rubber from Malay and Ceylon and demanding the repeal or drastic modification of existing legislation.

DR. N. P. INGLIS, of Liverpool, who has been recommended for the Blair Fellowship valued at £450 for a year's study abroad, has been engaged in research into the fatigue of metals under Professor Mason for the past three years.

FIRE DESTROYED the Widnes oil works of W. J. Bush and Co., Ltd., on Sunday. Large stores of oil were lost, and the damage is estimated at many thousands of pounds. Railway wagons were destroyed and neighbouring chemical works and several tanks of vitriol were endangered.

THE INSTITUTION OF THE RUBBER INDUSTRY has issued the first number of an official organ—the *I.R.I. Transactions*. Besides giving news of the Institution it reports papers presented, and generally affords an opportunity for members to keep in touch with the Institution and to ventilate relative matters.

FIRE-FIGHTING TESTS were carried out at Elstree, Herts, on Friday, July 17, when demonstrations were given of the efficiency of the "Continuous-Foam System." The demonstrations were organised by S. Dixon and Sons, Ltd., of Leeds, and Extinguishers, Ltd., of London. Burning oil, petrol, and wax and tar were successfully extinguished in a short time.

A FURTHER ATTACK AGAINST SCIENTIFIC INSTRUCTION was opened at Washington on Wednesday, when Mr. Loren Whittner, a clerk in the Federal Service, sought an injunction restraining the payment of salaries to Mr. W. P. Hay, head of the Biology and Chemistry Department, District of Columbia, and another school official, on the grounds that scientific instruction was incompatible with the Bible.

INDUSTRIAL COMBUSTION ENGINEERS, LTD., have recently received from Ireland an order for a specific gravity recorder for use on a condensed milk plant. A continuous record will be made of the specific gravity of condensed milk as it leaves the vacuum pans. The specific gravity varies between 1.250 and 1.370, and the record will be automatically compensated for temperature between 90° F. and 130° F. A circulating pump will also be provided which will be air tight and capable of working under vacuum.

APPLICATIONS ARE INVITED for the posts of demonstrator in physics at Leeds University; the Registrar, by August 6. Demonstrator in physics at Toronto University; Professor J. C. McLennan, Athenæum Club, Pall Mall, London, S.W.1. The Council of the University College of the South-West of England, Exeter, invite applications for the Andrews Simon research studentship, value £120, for the furtherance of experimental research in physics, chemistry, or other science. Registrar, by August 1.

TO CONSIDER THE QUESTION of insurance against bad debts in export trade, a committee which comprises representatives of the banks, accepting houses, insurance companies, Lloyds, the Association of British Chambers of Commerce, the Federation of British Industries, together with the Comptroller-General of the Department of Overseas Trade, has been appointed by the Parliamentary Secretary of the Department of Overseas Trade. The Secretary will be Mr. F. H. Nixon, of the Export Credits Department, and Colonel the Hon. Vernon Willey, President of the F.B.I., will be a member of the Committee.

THE PRESENT POSITION OF THE BEET SUGAR INDUSTRY is encouraging, according to Mr. Alfred Wood, secretary of the British Beet Society, speaking at Chester on Monday. Last year three factories were operating. This next season ten factories will be producing sugar. Apart from substantial extensions to the older factories £1,826,000 was being spent upon the building and equipment of the new factories, of which 85 per cent. was being expended in this country. Of this sum £1,035,800 is being spent in British engineering shops. In addition, upwards of 3,000 men were employed in factory erection. The capital raised to build and operate these factories was nearly £3,000,000 sterling. Five further factories were contemplated for the 1926 season. Last year 22,627 acres of beet were grown, and this year over 60,000 acres were being grown.

A DEFECT IN AN ICE PLANT at a London rink on Saturday, July 18, resulted in a workman being overcome by ammonia fumes.

MR. J. W. PEARSON, chairman of the British Oil and Cake Mills, Ltd., has been elected to the board of Lever Brothers, Ltd.

FIRE BROKE OUT at the paint works of Holmes and Sons, Shieldfield, on Wednesday night, but was extinguished before serious damage was done.

CARBON MONOXIDE POISONING resulted in the death of Arthur Leyland, of Blackley, who was found dead in his garage after the engine had been running.

TO EXPLOIT PETROLEUM resources in Turkey a company with a capital of 1,000,000 T. lire has been founded. The crude and refined substances and all derivatives are to be handled.

UNEMPLOYED INSURED WORKERS in the chemical industry during June totalled 8,412—7,149 men, and 1,263 women. These figures represent slight decreases on the previous month's results.

PROFESSOR A. G. GREEN is now in the United States. In an address before the South Jersey Section of the American Chemical Society he declared that the standard of a country's civilisation can be measured by the number of chemists employed.

A DENMAN BAYNES STUDENTSHIP for research in mathematics, chemistry, or physics, to the value of £100 will be awarded in August at Clare College, Cambridge. Applications, giving full details of qualifications, should be sent to the Tutor by August 8.

REPORTS STATE that orders to the total value of £15,000,000 are to be placed with British firms for plant and machinery for Russia. Most of the machinery, it is stated, will be for the oil, chemical, and mining industries, and the textile industry is also stated to be largely interested in the orders.

NEW PLANT FOR THE MANUFACTURE OF ARTIFICIAL SILK and superphosphates is in course of erection at Breslau. The factory will have a daily capacity of 50,000 kilos of artificial silk, and the viscose wood pulp method is to be employed. Dyeing and weaving plant has also been erected. Raw phosphates from Upper Silesia are to be used for the superphosphate production.

THE AWARDS MADE FOR 1925 by the Royal Commissioners for the Exhibition of 1851 include: Senior studentships to Mr. I. R. McHaffie, University College, London (physical chemistry), and to Mr. D. L. Thomson, Aberdeen (biochemistry); Overseas scholarships to Mr. V. M. Trikojus, University of Sydney (organic chemistry) and to Mr. J. J. Lennon, Dublin (organic chemistry).

DISEASES OF OCCUPATION recorded during June included 28 cases of lead poisoning, 5 cases of aniline poisoning, and cases of mercurial and arsenical poisoning. There were 13 instances of epitheliomatous ulceration in the oil industry, and one in the tar industry. Three cases of chrome ulceration were noted. There were also 9 fatal accidents in the chemical, etc., industry during June.

MR. L. P. SIDNEY, assistant secretary of the Iron and Steel Institute since 1904, has just resigned. Mr. Sidney was formerly chief metallurgist to the Shelton Iron, Steel, and Coal Co., Ltd., and was for some years on the staff of the *Iron and Coal Trades Review*. He was then reader and technical adviser to Charles Griffin and Co., Ltd., and now proposes to devote his whole time to technical journalism.

HOWDEN-LIUNGSTROM PREHEATERS (Land) Ltd., have received a further order from the British and Foreign Machinery Co., Ltd., for a large air preheater to work in conjunction with four Lancashire boilers at San Andres nitrate plant in Chile. The total heating surface of the preheater is to be 11,950 sq. ft.; air will be supplied to the furnace at about 485° F.; 14.4 per cent. saving in fuel is guaranteed.

"THE BLUE CIRCLE" is the title of a new house organ issued last week by the Cement Marketing Co., Ltd., of Portland House, Tothill Street, Westminster. It is very well printed and illustrated, and apart from staff news, includes instructive examples of the use of concrete. We learn from the magazine that the chairman of the company, Mr. P. M. Stewart, is now in Canada, and will visit the United States while over there. His principal object is to discuss a closer co-operation with the company's Canadian interests. *The Blue Circle* is a distinctly creditable production and should be a paying enterprise.

THE HARDINGE COMPANY, London, reports the recent sale of five 6 ft. by 58 in. Hardinge Pebble Mills for the Billiton Co. for grinding tin ore to 120 mesh; one 4 ft. 6 in. diameter Hardinge Mill for Cornwall for grinding tin ore; one 4 ft. 6 in. diameter Hardinge Mill for Italy, for grinding lead ore to 120 mesh; one 8 ft. Hum-mer electric screen for Burma Corporation, for screening lead ore; one 3 ft. Hum-mer electric screen for Buxton lime firms, for screening lime; three 8 ft. Hum-mer electric screens for the Coppee Company, for screening coal; one 4 ft. Hum-mer electric screen, for the Castle Fire Brick Co., Ltd., for screening shale.

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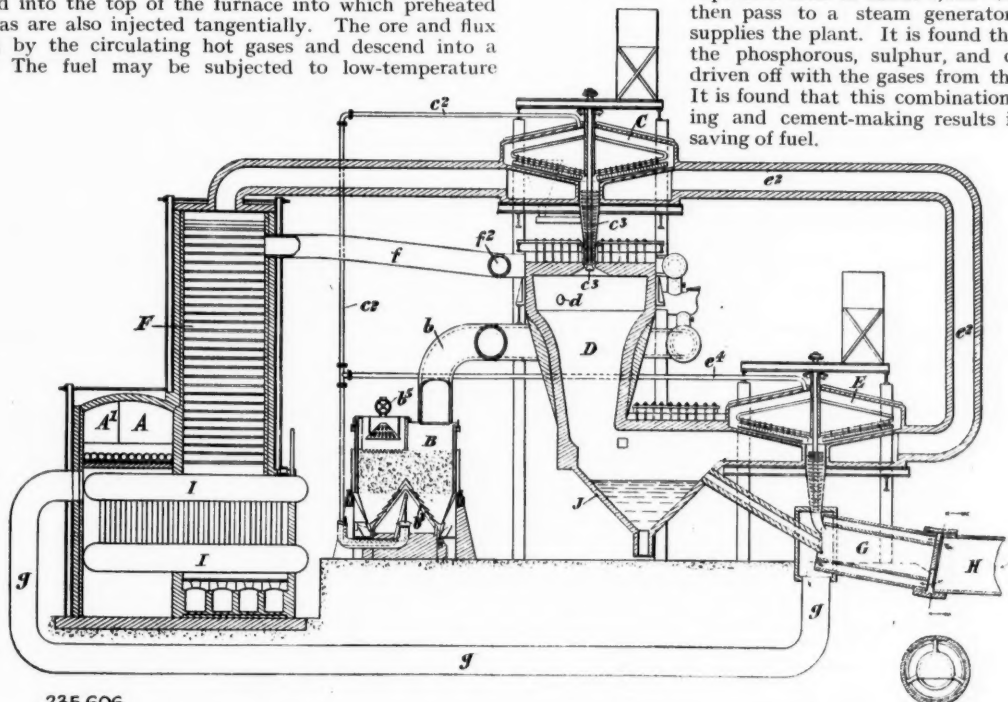
Abstracts of Complete Specifications

235,606. REDUCING ORES AND PRODUCING CEMENT, PROCESS AND APPARATUS FOR. A. Ferguson, 104, Addison Gardens, London. Application date, December 19, 1923.

The process is for reducing oxide ores to metals. The finely divided ore mixed with a powdered cement-making flux is injected into the top of the furnace into which preheated air and gas are also injected tangentially. The ore and flux are fused by the circulating hot gases and descend into a crucible. The fuel may be subjected to low-temperature

drum *G*. The heated air then passes through the pipes *g* to the recuperator *F*, and thence by pipe *f* to the pipe *f*² to meet the gas which is delivered by the producer *B* through the pipe *b*. The mixture is delivered to tangential burners *d*.

The hot waste gases from the preheater *E* may be passed through the pipe *e*² to the preheater *C*, and thence to the recuperator *F*. The temperature of the gases in the recuperator falls to about 1,100° C., and may then pass to a steam generator *I* which supplies the plant. It is found that most of the phosphorous, sulphur, and carbon are driven off with the gases from the furnace. It is found that this combination of smelting and cement-making results in a great saving of fuel.



235,606

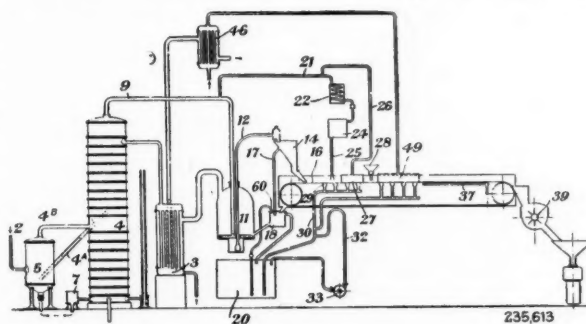
carbonisation, and the resulting coke employed in a gas producer. The distillation gases may be used to enrich the producer gas.

The ore and fluxing material are ground to pass through a mesh of 60 to the inch, and fed into a preheater *A* and heated to 500° C., while finely divided coal is heated in the retort *A*¹ by the waste heat from the recuperator *F* to about 400° C. The fuel is then conveyed through an airtight valve *b*⁵ to the producer *B*. The finely divided ore and flux pass to a second preheater *C* where they are heated to 1,000° C., but this temperature is reduced to 850° C. by the expulsion of carbon dioxide from calcium carbonate. The material used for the flux, together with material in the ore, is that which is required for the manufacture of cement. The material then passes through a spreader *C*² into the furnace *D*, where it is subjected to a temperature of about 1,800° C. The producer gas is projected tangentially.

Carbon dioxide is obtained from the calcium carbonate in the preheater *C*, and from another preheater *E* containing additional cement materials. The carbon dioxide passes by pipes *c*² and *e*⁴ to a distributing hood *b*³ below the producer *B*, to react with the carbon in the producer to produce carbon monoxide. The producer gas is practically free from nitrogen, which enables a higher temperature to be maintained in the furnace. Other ores such as tungsten, manganese, chromium, cobalt, molybdenum, nickel, titanium, and vanadium, can be introduced with the iron ore into the furnace *D* to yield an alloy. The cement-forming material which has been heated to 850°–1,000° C. in the preheater *E* by the waste combustion products is further heated by the liquid slag from the crucible *J*, which is run into the clinkering drum *G*. The resulting temperature of the cement material is about 1,300°–1,350° C., and this material passes off to the rotary cooler *H* through air passages in the jacket surrounding the

235,613. SULPHATE OF AMMONIA, MANUFACTURE OF. The Chemical Engineering and Wilton's Patent Furnace Co., Ltd., and T. O. Wilton, 76, Victoria Street, London, S.W.1; and N. Wilton, Norfolk House, Stanmore, Middlesex. Application date, February 20, 1924.

The apparatus is for producing dry and neutral sulphate of ammonia. The ammonia lye passes through a heater 3 to a



235,613

liquor still 4, from which it passes by pipe 44 to a lime still 5 after the free ammonia has been extracted. Lime or soda is supplied by the pipe 2, and the liquor then passes by pipe 4^B back to the lower half of the still 4, where fixed and free ammonia are driven off by steam. The spent liquor is drawn off through a valve 7. The ammonia vapour passes by a pipe 9 to a saturator 11, which receives sulphuric acid from the vessel 18 supplied by a pipe 60. The sulphate is discharged from the saturator through the pipe 12 to a receiver 14, which delivers it to a conveyor dryer 16. The mother liquor over-

flows through a pipe 17 to the vessel 18, and thence back to the saturator.

The sulphate passes along the conveyor dryer enclosed in a casing which is divided into a number of compartments. At first the sulphate is drained in the usual manner, as much liquor as possible being extracted by suction shoes 29. The liquor passes through a pipe 30 to a tank 20, and air passes through a pipe 32 to the pump 33. Ammonia is taken from the pipe 9 by the pipe 21 to the condenser 22 and storage vessel 24, from which it passes by pipe 25 to the conveyor, or ammonia gas may pass through the pipe 26 to a chamber 27, through which the conveyor passes. The free acid can also be neutralised by adding an alkaline solid at 28. The sulphate is then neutral, but still moist, and it is dried by hot air supplied to the chamber 49. The hot air may be obtained from the heater 46, heated by waste gases from the saturator. The salt can be further dried by means of steam pipes 37 below the conveyor, and is finally delivered into a rotating hot air dryer 39.

235,698. NITRATED ORGANIC COMPOUNDS, PRODUCTION OF. J. B. Menke, Emmastraat 8, Groningen, Holland. Application date, May 23, 1924.

The process is an improvement over the known nitration methods which employ a nitro-sulphuric or nitro-acetic acid mixture. The nitration is effected with metal nitrates, such as copper nitrate, in the presence of glacial acetic acid, acetic anhydride, acetyl halogenide, or mixtures of these. The nitration is effected at a low temperature, *e.g.*, below 60° C., so that little nitrous vapour is given off. If the temperature is raised, isomerisation products may be formed. In an example, aniline is added to a mixture of acetic anhydride and crystallised copper nitrate, the temperature being kept below 30° C. The temperature is raised to 30°–36° C. for some time, and the mixture poured into cold water, yielding a greyish-yellow solid. The solid is washed with water to remove copper nitrate, and crystallised from alcohol, the product being *o*-nitracetanilide. In a similar manner, acetoacetic ester can be nitrated with copper nitrate and acetic anhydride, and malonic ester, iso-succinic ester, and polyhydric alcohols may also be treated in this way. The nitration of phenol with ferric nitrate and glacial acetic acid yields mixed di-nitro-phenols, while nitration with copper nitrate and acetyl chloride yields 4 : 6-dichloro-2-nitrophenol. The nitration of dimethyl-aniline with copper nitrate and acetic anhydride yields trinitrophenyl-methyl-nitramine, and hexyl may be obtained from diphenyl-amine. Phenol may be nitrated with copper nitrate and acetic anhydride, yielding picric acid. Other nitrates may be employed such as cerium, manganese, zinc, nickel, or cobalt nitrate, and the process is capable of extensive application with aliphatic and aromatic bodies.

235,727. RECOVERING ACETIC ACID IN HIGH PERCENTAGE FORM FROM ACETIC ACID SOLUTIONS OF ACETYL CELLULOSE. Vereinigte Glanzstoff-Fabriken A.G., Elberfeld, Germany, and F. Paschke, Oberbruch, Kreis Heinsberg, Germany. Application date, July 3, 1924.

This process is based on the fact that if a solution of acetyl cellulose in acetic acid is mixed with an equal volume of saturated salt solution, the mixture does not separate into two phases, but solidifies to a soft jelly. If this jelly is subjected to a pressure which is increased very gradually, a considerable proportion of liquid containing a high percentage of acetic acid can be expressed. The residue may be moistened again with saturated salt solution, and pressed again, yielding a further quantity of strong acetic acid. This may be repeated several times, the moistening being effected with water. The total quantity of liquid expressed may contain about 50 per cent. of acetic acid.

NOTE.—Abstracts of the following specifications which are now accepted, appeared in THE CHEMICAL AGE when they became open to inspection under the International Convention:—213,251 (M. Naef and Co.) relating to manufacture of farnesol, see Vol. X, p. 547; 213,285 (Chemische Fabrik von Heyden Akt.-Ges.) relating to soluble antimony compounds, see Vol. X, p. 578; 213,567 (F. Pollak) relating to condensation products from urea and formaldehyde, see Vol. X, p. 578; 213,599 (A. F. Mayerhofer) relating to production of acids, see Vol. X, p. 603; 214,237 (Farbwerke vorm. Meister, Lucius, and Brüning) relating to complex arsenobenzene compounds, see Vol. X, p. 630; 219,667 (C. J. G. Aarts) relating to ex-

traction of zinc from zinc oxide compounds, see Vol. XI, p. 31 (Metallurgical Section); 220,320 (Naugatuck Chemical Co.) relating to retardation of the deterioration of rubber, see Vol. XI, p. 401; 222,838 (A. F. Mayerhofer) relating to decomposition of alkali salts, see Vol. XI, p. 609; 223,919 (Fabrique Nationale de Produits Chimiques et d'Explosifs Anciens, Etablissement Chinigonet et Delattre Soc. Anon.) relating to production of ammonia from cyanamides, see Vol. XII, p. 13; 226,783 (Soc. Anon. d'Eclairage et d'Applications Electriques) relating to separation of krypton and xenon, see Vol. XII, p. 209.

International Specifications not yet Accepted

234,072. SEPARATING POTASSIUM AND SODIUM HYDROXIDES. Soc. of Chemical Industry in Basle, Switzerland. International Convention date, May 15, 1924.

A solution containing caustic potash and soda in equal proportions is concentrated to 60° Bé., and crystallised at 60° C., when the potash separates. The liquor is then diluted to 55° Bé. and cooled to obtain caustic soda, and the process is then repeated. If the solution contains 60 per cent. of potash, it is concentrated to 61° Bé., and crystallised at 70° C. to obtain the potash. The remaining liquor may then be treated as in the first example. The crystals contain about 10 per cent. of the other salt in each case, and are purified by dissolving in water and repeating the process.

234,078. CONCENTRATING NITROUS GASES. Norsk Hydro-Elektrisk Kvaelfstofaktieselskab, 17, Solliqatzen, Oslo, Norway. International Convention date, May 15, 1924.

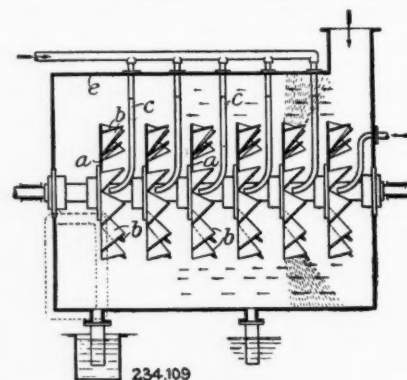
Dilute nitrous gases are absorbed in a tower through which a saturated solution of trisodium phosphate is passed, and the solution neutralised and evaporated. The concentrated liquor is then decomposed by hot nitrous gases from an electric arc, liberating concentrated nitrous gases, which are absorbed in water. The decomposition of the phosphate containing nitrous gases may be effected by allowing it to fall on a rapidly rotating disc, or compressed air may be blown through it, or the salt may be passed through a rotating cylinder or a tower provided with shelves. The liberated gases may be cooled to obtain liquid nitrogen peroxide.

234,086. DYES. Soc. of Chemical Industry in Basle, Switzerland. International Convention date, May 13, 1924. Addition to 205,525.

Products which dye cotton red-violet to bordeaux shades can be obtained by condensing 5- or 8-amino-2 : 1-anthraquinone-acridone with a 1 : 3 : 5-triazine derivative halogenated in the nucleus. The products may be further condensed with another compound. According to examples, 8-amino-2 : 1-anthraquinone-acridone is condensed with cyanuric chloride; and 4-amino-2 : 1-anthraquinone-acridone is condensed with cyanuric chloride, and then with 5-amino-2 : 1-anthraquinone-acridone. The acridones are obtained by condensing 5- and 8-amino-1-chloranthraquinones with anthranilic acid and closing the acridone rings by chlor-sulphonic acid.

234,109. WASHING AND COOLING GASES. Firm of E. Theisen, 25, Herchelstrasse, Munchen, Germany. International Convention date, May 15, 1924.

Apparatus for treating gases with liquids comprises a casing



e containing a series of discs *a* mounted on a rotating shaft. The vanes *b* on the discs may be formed by bending the rims, or may be separate. The liquid is supplied by pipes *c*.

234,104. NITROGEN. Hydrazote, 103, Boulevard de Waterloo, Brussels. (Assignees of Soc. l'Oxydrique Française, 25, Rue Beranger, Malakoff, Seine, France.) International Convention date, May 19, 1924.

Gases rich in nitrogen are passed over hot reduced iron to remove oxygen, and the iron oxide formed is then reduced. The apparatus comprises a number of cast iron tubes set in masonry through which gas containing nitrogen is passed. If combustion gas is used, the oxidation of the iron is effected at a low temperature to avoid the formation of carbon monoxide, and the carbon dioxide and sulphur dioxide in the nitrogen are absorbed in water or alkalis.

234,122. PHOSPHORIC ACID. Firm of E. Merck, Darmstadt, Germany. International Convention date, May 14, 1924.

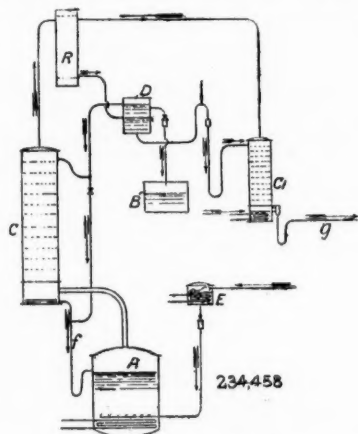
Phosphoric acid of 80 per cent. strength is treated with phosphoretted hydrogen, and then with carbon dioxide to remove excess of phosphoretted hydrogen. Arsenic is precipitated in the form of flakes, and is filtered off.

234,138. HYPOPHOSPHITES. Firm of E. Merck, Darmstadt, Germany. International Convention date, May 17, 1924.

Phosphorus is placed in milk of lime in an autoclave, and the air replaced by nitrogen. At 6 atmospheres pressure, the phosphoretted hydrogen is drawn off through lime towers and burned to phosphoric acid. Nitrogen is passed through the autoclave to expel the remaining phosphoretted hydrogen, and the residue filtered. This consists of lime and calcium phosphite, and it is washed, dissolved in hydrochloric acid, and re-precipitated by caustic soda. The filtrate is neutralised by carbon dioxide, heated, filtered, and evaporated in vacuo, yielding a hypophosphite.

234,458. ESTERS. Soc. Anon. des Distilleries des Deux-Sèvres, Melle, Deux-Sèvres, France. International Convention date, May 24, 1924.

The process is for the continuous manufacture of esters of aliphatic or aromatic acids, ethyl acetate being given as an example. A boiler *A* contains commercial acetic acid with



some benzene sulphonic acid as a catalyst, and an equimolecular mixture of alcohol and acetic acid is continuously supplied from the tank *E*. Vapours of ethyl acetate, water, and traces of acetic acid, pass to a column *C*, and the acid is returned to the boiler. The ethyl acetate and water pass to a condenser *R* and separating vessel *D*, and the upper layer of ethyl acetate is drawn off to a tank *B*. The lower layer is mainly water, and is rectified in a column *C*₁, the ethyl acetate returning to the condenser *R*. In the manufacture of butyl acetate, the rectification of the lower layer, consisting of pure water, is omitted. With more volatile esters such as methyl and ethyl formates, and methyl acetate, the water cannot be removed by distillation with the ester, but the mixture is drawn off from the boiler and rectified. A modified apparatus suitable for producing ethyl formate, is also described. Esters of medium volatility such as propyl, butyl and amyl formates, ethyl, propyl, butyl, and amyl acetates, methyl, ethyl and propyl propionates, methyl and ethyl butyrates, form a constant boiling mixture with the water produced in the esterification.

LATEST NOTIFICATIONS.

- 236,891. Manufacture of polymerised products from styrol and its homologues. Naugatuck Chemical Co. July 12, 1924.
236,928. Treatment of wood-oil used in the manufacture of varnishes and paints and for other purposes. Taubmans, Ltd. July 10, 1924.

Specifications Accepted with Date of Application

- 221,513. Nitric acid from ammonia, Production of. Synthetic Ammonia and Nitrates, Ltd. September 6, 1923.
223,911. Condensation products of the anthraquinone series, Manufacture of. Soc. of Chemical Industry in Basle. October 26, 1923. Addition to 205,525.
225,174. Halogenated hydrocarbons, Process for the reduction of. Soc. Chimique des Usines du Rhône. November 21, 1923.
236,256. Desulphurisation and concentration of sulphide iron ores. W. S. Millar. March 7, 1924.
235,263. Purification of oils and other liquids by bauxite or other adsorbent. F. G. P. Remfry and A. E. Dunstan. March 29, 1924.
236,281. Cellulose containing solutions, Manufacture of. A. Classen. April 2, 1924.
236,332. Indigo dyestuffs and intermediate products, Manufacture of. O. Y. Imray. (Soc. of Chemical Industry in Basle.) May 8, 1924.
236,336. Cellulose hydrates, Application of. C. F. Cross and Viscose Development Co., Ltd. May 12, 1924.
236,368. Lead oxides, Process of manufacturing. G. Shimadzu. June 26, 1924.
236,379. Olefine oxides, Process of making. J. N. Burdick. July 9, 1924.
236,420. Distilling carbonaceous material, Process for. H. Fairbrother. (Jackson Research Corporation.) September 23, 1924.
236,440. Sparingly-soluble lead compounds from lead sulphate, Process for the production of. S. G. S. Dicker. (Consortium für Nassmetallurgie.) November 14, 1924.
236,494. Fertilisers, Manufacture and production of. J. Y. Johnson. (Badische Anilin & Soda Fabrik.) March 14, 1925.

Applications for Patents

- Akt.-Ges. für Anilin-Fabrikation. Manufacture of dyestuffs. 18,112. July 15. (Germany, July 28, 1924.)
Ashworth, A. Dyeing apparatus. 17,959. July 14.
Badische Anilin- und Soda-Fabrik, and Johnson, J. Y. Manufacture of dyestuffs. 17,890, 17,891. July 13.
Bramwell, F. H., and Synthetic Ammonia and Nitrates, Ltd. Catalytic apparatus for synthesis of ammonia. 18,255. July 17.
Bramwell, F. H., and Synthetic Ammonia and Nitrates, Ltd. Catalytic apparatus. 18,256. July 17.
Campbell, W. H., and Humberstone, J. E. Separation of liquids and solids. 18,082. July 15.
Carpmael, W., and Farbenfabriken vorm. F. Bayer and Co. Manufacture of complex alkali or alkali earths antimony compounds. 18,326. July 17.
Caspary, W. A. Manufacture of oxygenated products from aromatic hydrocarbons. 18,395. July 18.
Chemische Fabrik Grünau Laudshoff and Meyer Akt.-Ges. Process of reducing surface tension and viscosity of an emulsion of lecithin and glycerine. 18,359. July 18.
Coke and Gas Ovens, Ltd., and Pearson, R. Neutralizing free acid in sulphate of ammonia. 18,027. July 14.
Dicker, S. G. S., and Kalmus, Comstock and Wescott, Inc. Treatment of ores, etc., containing oxide of iron. 18,336. July 17.
Dicker, S. G. S., and Kudoh. Preparation of concentrated sulphur dioxide gas. 18,346. July 17.
Dicker, S. G. S. Catalytic process for producing and fuming sulphuric acid. 18,347. July 17.
Fulton, C. W., and Hutton, H. W. Manufacture of emulsions. 18,287. July 17.
Gladitz, C., and Rogers, F. H. Process of forming chemical compounds, etc. 18,205. July 16.
Siemens and Co., Geb. Production of calcium carbide or ferro-silicon, etc. 17,884. July 13. (Germany, September 19, 1924.)
Smith, T. B. Apparatus for drying and neutralising sulphate of ammonia, etc. 17,895. July 13.

Chilean Nitrate Control in London

THE Association de Productores de Salitre de Chile, Valparaiso, has sanctioned the transfer of the Canadian office from the control of New York to that of the Chilean Nitrate Committee, London, England, the new affiliation to be officially completed as from July 1. In order to confer with the principals in London, and to attend a convention of nitrate delegates in Rome, Mr. B. Leslie Emslie, Toronto, Director for Canada, will leave for Europe on August 1 and will probably return about the end of September.

London Chemical Market

The following notes on the London Chemical Market are specially supplied to THE CHEMICAL AGE by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., and may be accepted as representing these firms' independent and impartial opinions.

London, July 23, 1925.

THE Chemical trade this week has been if anything slightly more active although prevailing conditions are much the same. Prices again show very little change while export demand continues on the small side.

General Chemicals

ACETONE stocks remain very small and the price is unchanged at £75 to £76 per ton; the tendency is slightly firmer.

ACID ACETIC has been quite active and good business is reported, 80% technical is offered at £38 per ton and £1 per ton extra for the pure.

ACID CITRIC is still a lifeless market at 1s. 5d. per lb.

ACID FORMIC has again been quite active and is quoted at £48 to £49 per ton for 85%; the tendency is firmer.

ACID LACTIC is unchanged and there is a moderate amount of business offer at £43 per ton to £44 per ton for 50% by weight.

ACID OXALIC continues extremely quiet and, unfortunately, there are a few second-hand parcels still in evidence, price nominally 3½d. per lb.

ACID TARTARIC continues weak and only a small business is reported at the current price of 11½d. per lb.

ALUMINA SULPHATE is in moderate request and is quoted at about £6 5s. per ton.

ARSENIC is as idle as ever with the market nominally standing at £24 per ton.

BARIUM CHLORIDE has been more active, but price is unchanged at £9 5s. to £9 10s. per ton.

CREAM OF TARTAR continues fairly active at £74 to £77 per ton, there has been quite a good demand on export account.

EPSOM SALTS is unchanged.

FORMALDEHYDE is only a moderate market, but the prices are maintained and the material is quoted at from £40 to £42 per ton, according to quantity and position.

LEAD ACETATE remains a bright spot at £45 to £45 10s. per ton for white and about £43 per ton for brown.

LIME ACETATE is quiet at £15 10s. per ton for grey, but there is a firmer tendency and a fair volume of inquiry in the market.

METHYL ALCOHOL continues lifeless and the nominal price remains at £48 per ton c.i.f.

POTASSIUM CAUSTIC is unchanged.

POTASSIUM CHLORIDE remains in good demand, but continues to be very scarce, the average price quoted being 4½d. per lb.

POTASSIUM PERMANGANATE moves fairly steadily into consumption and is quoted at the unchanged figure of 7½d. per lb.

POTASSIUM PRUSSATE is extremely firm and a good business is reported at 7½d. per lb.

SODIUM ACETATE.—Quite a satisfactory business has been transacted at the current figure of £18 10s. to £19 per ton.

SODIUM BICHROMATE.—A moderate business is reported at British makers' figures.

SODIUM HYPOSULPHITE continues in slow demand for commercial, but on the other hand business for photographic has been exceptionally brisk, prices are well maintained at British makers' figures.

SODIUM PRUSSATE.—Inquiry is fair and the material can be obtained at 4½d. per lb.

SODIUM NITRITE is in fairly active demand at £22 10s. to £22 15s. per ton.

SODIUM SULPHIDE is unchanged.

ZINC SULPHATE.—Quite a good business is reported at the average figure of £13 per ton.

Coal Tar Products

The market for many Coal Tar Products is slightly firmer since last week. This firmness, however, is not due to any increased volume of business, but is consequent on the possibility of a coal stoppage in the near future.

90% BENZOL is firm at 1s. 9d. to 1s. 10d. per gallon on rails.

PURE BENZOL is quoted at 1s. 11d. to 2s. per gallon on rails.

CREOSOTE OIL is scarce for the near position, and somewhat firmer in price. It is quoted at 5½d. per gallon on rails in the North, while the price in London is quoted at 7d. to 7½d. per gallon.

CRESYLIC ACID is quietly steady at 1s. 7d. to 1s. 8d. per gallon on rails for the pale quality 97/99%, while the dark quality 95/97% can be bought in the region of 1s. 4d. per gallon.

SOLVENT NAPHTHA is none too plentiful; and is firm at 1s. 4d. to 1s. 4½d. per gallon on rails.

HEAVY NAPHTHA can be bought at 1s. 1d. per gallon on rails.

NAPHTHALENES are still weak, the lower grades being worth from £3 to £3 15s. per ton, while the 74/76 quality is quoted at £5 to £5 10s. per ton, and the 76/78 quality at £5 15s. to £6 per ton.

PITCH is unchanged.

Latest Oil Prices

LONDON.—LINSEED OIL steady at a decline of 5s. to 7s. 6d. per ton. Spot, £41 10s.; July and August, £40 7s. 6d.; September-December, £40 10s.; January-April, £40 2s. 6d. RAPE OIL steady. Crude crushed, spot, £48 10s.; technical refined, £51 10s. COTTON OIL firm. Refined common edible, £48; Egyptian crude, £43; deodorised, £50. TURPENTINE firm and 6d. per cwt. higher. American, spot, 66s. 6d.; August, 66s. 9d.; September-December, 67s. 9d. Business was done in spot at 66s. 3d.; August and September at 66s. 6d.

HULL.—LINSEED OIL.—Spot to September-December, £40 5s. COTTON OIL.—Bombay, crude, £38 15s.; Egyptian, crude, £43; edible refined, £47; deodorised, £49; technical, £42 10s. PALM KERNEL OIL, crushed, 5½ per cent., spot, £43 10s. GROUNDNUT OIL crushed-extracted, £48; deodorised, £52. SOYA OIL, extracted and crushed, £42; deodorised, £45 10s. RAPE OIL, extracted, £47 10s. per ton, net, cash terms, ex mill. CASTOR OIL, COD OIL unaltered.

Nitrogen Products Market

Export.—During the last week the British producers continued to sell for export on the basis of £11 10s. per ton, f.o.b. single bags, with 12s. 6d. extra for double bags, and considerable quantities were disposed of at this figure. For forward delivery there is very little business being done, as the threat of a coal strike makes the producers nervous about quoting for forward.

Home.—The home demand continues quiet, and prices remain unchanged. A coal stoppage would not have the same effect upon world production as the previous stoppage, because production by synthetic process has gone ahead, both at home and abroad. A strike now, however, would have the effect of retarding the consumption of sulphate of ammonia, and, as a consequence, the strike would be injurious in the long run, though it would lead to a slightly higher level of prices for the present season.

Nitrate of Soda.—During the last week the nitrate market has been distinctly weaker, and cargoes have changed hands as low as £11 8s. per ton, c.i.f. chief European ports. The market had been quiescent for a short time with quotations remaining firm at £11 14s., and no doubt the drop has been due to the paucity of sales, which is probably a consequence of the low offerings of sulphate of ammonia.

Cement Developments

SPEAKING at a meeting of Eastwoods Cement, Ltd., in London on Monday, Mr. Horace Boot (chairman) said that great progress had been made since the company was floated in May last. At the works lime kilns had been started and the property was known to contain very fine deposits of lime. They had the advantage of the results of previous research into the raw materials available, and it was their intention to instal the most modern plant, and engineers were laying out the works so that they could eventually show an output of 3,000 tons a week. An interesting departure was made in the exhibition, at the meeting, of a model of the works as they will appear when completed.

Weekly Prices of British Chemical Products

The prices and comments given below respecting British chemical products are based on direct information supplied by the British manufacturers concerned. Unless otherwise qualified, the figures quoted apply to fair quantities, net and naked at makers' works.

General Heavy Chemicals

Acid Acetic, 40% Tech.—£21 to £23 per ton.
 Acid Boric, Commercial.—Crystal, £40 per ton, Powder, £42 per ton.
 Acid Hydrochloric.—3s. 9d. to 6s. per carboy d/d., according to purity, strength and locality.
 Acid Nitric, 80° Tw.—£21 10s. to £27 per ton, makers' works, according to district and quality.
 Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations: 140° Tw., Crude Acid, 60s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
 Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
 Bleaching Powder.—Spot, £10 10s. d/d; Contract, £10 d/d. 4 ton lots.
 Bisulphite of Lime.—£7 10s. per ton, packages extra, returnable.
 Borax, Commercial.—Crystal, £25 per ton. Powder, £26 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
 Calcium Chlorate (Solid).—£5 12s. 6d. to £5 17s. 6d. per ton d/d, carriage paid.
 Copper Sulphate.—£25 to £25 10s. per ton.
 Methylated Spirit 64 O.P.—Industrial, 2s. 5d. to 2s. 11d. per gall. Mineralised, 3s. 8d. to 4s. per gall., in each case according to quantity.
 Nickel Sulphate.—£38 per ton d/d.
 Nickel Ammonia Sulphate.—£38 per ton d/d.
 Potash Caustic.—£30 to £33 per ton.
 Potassium Bichromate.—5d. per lb.
 Potassium Chlorate.—3½d. per lb., ex wharf, London, in cwt. kegs.
 Salammuniac.—£45 to £50 per ton d/d. Chloride of ammonia, £37 to £45 per ton. Carr. pd.
 Salt Cake.—£3 15s. to £4 per ton d/d. In bulk.
 Soda Caustic, Solid.—Spot lots delivered, £15 12s. 6d. to £18 per ton, according to strength: 20s. less for contracts.
 Soda Crystals.—£5 to £5 5s. per ton ex railway depots or ports.
 Sodium Acetate 97/98%.—£24 per ton.
 Sodium Bicarbonate.—£10 10s. per ton, carr. paid.
 Sodium Bichromate.—4d. per lb.
 Sodium Bisulphite Powder 60/62%.—£17 per ton for home market, 1-cwt. iron drums included.
 Sodium Chlorate.—3d. per lb.
 Sodium Nitrate refined 96%.—£13 5s. to £13 10s. per ton, ex Liverpool.
 Sodium Nitrite 100% basis.—£27 per ton d/d.
 Sodium Phosphate, £14 per ton, f.o.r. London, casks free.
 Sodium Sulphate (Glauber Salts).—£3 12s. 6d. per ton.
 Sodium Sulphide conc. solid. 60/65.—£15 per ton d/d. Contract £14 15s. Carr. pd.
 Sodium Sulphide Crystals.—£9 5s. per ton d/d. Contract £9 2s. 6d. Carr. pd.
 Sodium Sulphite, Pea Crystals.—£14 per ton f.o.r. London, 1-cwt. kegs included.

Coal Tar Products

Acid Carbollic Crystals.—3½d. to 4½d. per lb., according to quantity. Very quiet. Crude 60's, no market owing to weakness of crystals.
 Acid Cresylic 97/99.—1s. 6d. to 1s. 7d. per gall. Little demand.
 Pale, 95%, 1s. 5d. to 1s. 6d. per gall. Dark, 1s. 3d. to 1s. 4½d. per gall.
 Anthracene Paste 40%.—3d. per unit per cwt.—Nominal price. No business.
 Anthracene Oil, Strained.—7d. to 8d. per gall. Unstrained, 6d. to 7d. per gall.
 Benzol.—Crude 65's.—11d. to 1s. 3d. per gall., ex works in tank wagons. Standard Motor, 1s. 8d. to 1s. 10d. per gall., ex works in tank wagons. Pure, 1s. 11d. to 2s. 3d. per gall., ex works in tank wagons. Demand exceeds production.
 Toluol.—90%, 1s. 7d. to 1s. 9d. per gall. More inquiry. Pure, 1s. 11d. to 2s. per gall.
 Xylol Commercial.—2s. 3d. per gall. Pure, 3s. 3d. per gall.
 Creosote.—Cresylic, 20/24%, 8d. per gall. Standard specification, middle oil, heavy, 6½d. to 7d. per gall. Fair business.
 Naphtha.—Crude, 8d. to 9d. per gall. Solvent 90/160, 1s. 5d. to 1s. 9d. per gall. Demand good. Solvent 90/190, 1s. to 1s. 4d. per gall. Fair demand.
 Naphthalene Crude.—Drained Creosote Salts, £3 to £5 per ton. Market quiet. Whizzed or hot pressed, £6 to £9 per ton.
 Naphthalene.—Crystals and Flaked, £10 to £11 per ton, according to districts. Very quiet.
 Pitch.—Medium soft, 40s. to 42s. 6d. per ton, according to district. Slightly more inquiry.
 Pyridine.—90/160, 19s. per gall. Heavy, 11s. 6d. to 12s. per gall. Fair business.

Intermediates and Dyes

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acetic Anhydride 95%.—1s. 7d. per lb.
 Acid H.—3s. 9d. per lb. 100% basis d/d.
 Acid Naphthionic.—2s. 2d. per lb. 100% basis d/d.
 Acid Neville and Winther.—5s. 8d. per lb. 100% basis d/d.
 Acid Salicylic, technical.—11d. to 11½d. per lb. Steady demand.
 Acid Sulphanilic.—9d. per lb. 100% basis d/d.
 Aluminium Chloride, anhydrous.—10d. per lb. d/d.
 Aniline Oil.—7½d. per lb. naked at works.
 Aniline Salts.—8d. per lb. naked at works.
 Antimony Pentachloride.—1s. per lb. d/d.
 Benzidine Base.—3s. 8d. per lb. 100% basis d/d.
 Benzyl Chloride 95%.—1s. 1d. per lb.
 p-Chlorophenol.—4s. 3d. per lb. d/d.
 p-Chloraniline.—3s. per lb. 100% basis.
 o-Cresol 29/31° C.—3d. per lb. Demand quiet.
 m-Cresol 98/100%.—2s. 1d. per lb. Demand moderate.
 p-Cresol 32/34° C.—2s. 1d. per lb. Demand moderate.
 Dichloraniline.—2s. 3d. per lb.
 Dichloraniline S. Acid.—2s. 3d. per lb. 100% basis.
 Diethylaniline.—4s. 3d. per lb. d/d., packages extra, returnable.
 Dimethylaniline.—2s. 2d. per lb. d/d. Drums extra.
 Dinitrobenzene.—9d. per lb. naked at works.
 Dinitrochlorobenzene.—£84 10s. per ton d/d.
 Dinitrotoluene.—48/50° C. 8d. to 9d. per lb. naked at works. 66/68° C. 1s. per lb. naked at works.
 Diphenylaniline.—2s. 10d. per lb. d/d.
 G. Salt.—2s. 2d. per lb. 100% basis d/d.
 a-Naphthol.—2s. 3d. per lb. d/d.
 B-Naphthol.—1s. per lb. d/d.
 a-Naphthylamine.—1s. 3½d. per lb. d/d.
 B-Naphthylamine.—3s. 9d. per lb. d/d.
 m-Nitraniline.—4s. 2d. per lb. d/d.
 p-Nitraniline.—2s. 2d. per lb. d/d.
 Nitrobenzene.—5½d. to 5½d. per lb. naked at works.
 o-Nitrochlorbenzol.—2s. 3d. per lb. 100% basis d/d.
 Nitronaphthalene.—10d. per lb. d/d.
 p-Nitrophenol.—1s. 9d. per lb. 100% basis d/d.
 p-Nitro-o-amido-phenol.—4s. 6d. per lb. 100% basis.
 m-Phenylene Diamine.—4s. per lb. d/d.
 p-Phenylene Diamine.—9s. 9d. per lb. 100% basis d/d.
 R. Salt.—2s. 4d. per lb. 100% basis d/d.
 Sodium Naphthionate.—2s. 2d. per lb. 100% basis d/d.
 o-Toluidine.—10d. per lb.
 p-Toluidine.—2s. 3d. per lb. naked at works.
 m-Tolylene Diamine.—4s. per lb. d/d.

Wood Distillation Products

Acetate of Lime.—Brown £9 10s. to £10. Quiet market. Grey £15 per ton. Liquor, 9d. per gall. 32° Tw.
 Acetone.—£73 per ton.
 Charcoal.—£7 5s. to £8 10s. per ton, according to grade and locality.
 Iron Liquor.—1s. 7d. per gall. 32° Tw. 1s. 2d. per gall. 24° Tw.
 Red Liquor.—10d. to 1s. per gall. 14/15° Tw.
 Wood Creosote.—2s. 9d. per gall. Unrefined.
 Wood Naphtha, Miscible.—4s. 3d. per gall.
 60% O.P. Solvent, 4s. 6d. per gall. 40% O.P.
 Wood Tar.—£4 per ton.
 Brown Sugar of Lead.—£43 per ton.

Rubber Chemicals

Antimony Sulphide.—Golden, 7½d. to 1s. 5d. per lb., according to quality. Crimson, 1s. 5d. to 1s. 7½d. per lb., according to quality.
 Arsenic Sulphide, Yellow.—2s. per lb.
 Barytes.—£3 10s. to £6 15s. per ton, according to quality.
 Cadmium Sulphide.—4s. 4d. per lb.
 Carbon Bisulphide.—£25 to £28 per ton, according to quantity.
 Carbon Black.—5½d. per lb., ex wharf.
 Carbon Tetrachloride.—£55 to £60 per ton, according to quantity, drums extra.
 Chromium Oxide, Green.—1s. 3d. per lb.
 Diphenylguanidine, 4s. to 4s. 3d. per lb.
 Indiarubber Substitutes, White and Dark.—5½d. to 6½d. per lb.
 Lamp Black.—£43 per ton, barrels free.
 Lead Hyposulphite.—9d. per lb.
 Lithopone, 30%.—£22 10s. per ton.
 Mineral Rubber "Rubpron".—£13 12s. 6d. per ton f.o.r. London.
 Sulphur.—£9 to £11 per ton, according to quality.
 Sulphur Chloride.—4d. per lb., carboys extra.
 Sulphur Precip. B.P.—£50 to £55 per ton.

Thiocarbamide.—2s. 6d. to 2s. 9d. per lb.
 Thiocarbamide.—2s. 1d. to 2s. 3d. per lb.
 Vermilion, Pale or Deep.—5s. per lb.
 Zinc Sulphide.—1s. 1d. per lb.

Pharmaceutical and Photographic Chemicals

Acid, Acetic 80% B.P.—£40 per ton ex wharf London in glass containers.
 Acid, Acetyl Salicylic.—2s. 8d. to 2s. 10d. per lb. British makers meeting foreign competition in quality and price.
 Acid, Benzoic B.P.—2s. to 2s. 3d. per lb., according to quantity.
 Acid, Boric B.P.—Crystal £46 per ton, Powder £50 per ton. Carriage paid any station in Great Britain.
 Acid, Camphoric.—10s. to 21s. per lb.
 Acid, Citric.—1s. 3½d. to 1s. 4½d. per lb., less 2½%.
 Acid, Gallic.—2s. 9d. per lb. for pure crystal, in cwt. lots.
 Acid, Pyrogallol, Crystals.—5s. 4d. to 5s. 6d. per lb.
 Acid, Salicylic.—1s. 2d. per lb., in ton lots. Good demand. Technical.—11d. per lb.
 Acid, Tannic B.P.—2s. 8d. per lb.
 Acid, Tartaric.—11½d. per lb., less 5%.
 Amidol.—9s. per lb., d/d.
 Acetanilide.—1s. 5d. per lb. for quantities.
 Amidopyrin.—13s. 3d. per lb.
 Ammonium Benzoate.—3s. 3d. to 3s. 6d. per lb., according to quantity.
 Ammonium Carbonate B.P.—£37 per ton. Powder, £39 per ton in 5 cwt. casks.
 Atropine Sulphate.—11s. 6d. per oz. for English make.
 Barbitone.—11s. per lb.
 Benzonaphthol.—3s. 6d. per lb. spot.
 Bismuth Carbonate.—12s. 9d. to 14s. 9d. per lb. } Prices advanced.
 Bismuth Citrate.—11s. 4d. to 13s. 4d. per lb. } Supplies of the
 Bismuth Salicylate.—10s. 2d. to 12s. 2d. per lb. } metal are still re-
 Bismuth Subnitrate.—10s. 9d. to 12s. 9d. per lb. } stricted.
 according to quantity.
 Borax B.P.—Crystal £29, Powder £30 per ton. Carriage paid any station in Great Britain.
 Bromides.—Potassium, 2s. 1d. to 2s. 3d. per lb.; sodium, 2s. 2d. to 2s. 4d. per lb.; ammonium, 2s. 6d. to 2s. 8d. per lb., all spot. British or Imported. Prices unchanged. Firm.
 Calcium Lactate.—1s. 6½d. to 1s. 8d., according to quantity.
 Chloral Hydrate.—3s. 5d. to 3s. 6d. per lb., duty paid.
 Chloroform.—2s. 5½d. to 2s. 7½d. per lb., according to quantity.
 Creosote Carbonate.—6s. 9d. per lb.
 Formaldehyde.—£38 per ton, in barrels ex wharf.
 Glycerophosphates.—Fair business passing. Calcium, soluble and citrate free, 7s. per lb.; iron, 8s. 9d. per lb.; magnesium, 9s. per lb.; potassium, 50%, 3s. 6d. per lb.; sodium, 60%, 2s. 6d. per lb.
 Guaiacol Carbonate.—7s. per lb.
 Hexamine.—2s. 4d. powder crystal, 2s. 6d. free running crystal, per lb.
 Homatropine Hydrobromide.—30s. per oz.
 Hydrastine Hydrochloride.—English make offered at 120s. per oz.
 Hydrogen Peroxide (12 vols.).—1s. 8d. per gallon f.o.r. makers' works, naked.
 Hydroquinone.—4s. 1½d. per lb.
 Hypophosphites.—Calcium, 3s. 6d. per lb., for 28 lb. lots; potassium, 4s. 1d. per lb.; sodium, 4s. per lb.
 Iron Ammonium Citrate B.P.—1s. 8d. to 1s. 11d. per lb. Green, 2s. 2d. to 2s. 7d. per lb. U.S.P., 1s. 7d. to 1s. 10d. per lb.
 Magnesium Carbonate.—Light Commercial, £34 per ton net. Light pure, £46 per ton.
 Magnesium Oxide.—Light Commercial, £65 per ton, less 2½%, price reduced; Heavy Commercial, reduced to £24 per ton, less 2½%; Heavy Pure, 2s. to 2s. 3d. per lb., according to quantity.
 Menthol.—A.B.R. recrystallised B.P., 47s. 6d. per lb.; July delivery. Synthetic, 22s. 6d. to 31s. 6d. per lb., according to quality. English make.
 Mercurials.—Red oxide, 5s. 2d. to 5s. 4d. per lb.; Corrosive sublimate, 3s. 7d. to 3s. 9d. per lb.; white precipitate, 4s. 6d. to 4s. 8d. per lb.; Calomel, 3s. 10d. to 4s. per lb. Very quiet.
 Methyl Salicylate.—1s. 4½d. to 1s. 8d. per lb.
 Methyl Sulphonol.—17s. 9d. per lb.
 Metol.—11s. per lb. British make.
 Paraformaldehyde.—2s. for B.P. quality.
 Paraldehyde.—1s. 4d. per lb., in free bottles and cases.
 Phenacetin.—4s. 2d. per lb. in cwt. lots. Slightly cheaper.
 Phenazone.—6s. 2d. per lb.
 Phenolphthalein.—4s. to 4s. 3d. per lb., according to quantity.
 Potassium Bitartrate 99/100% (Cream of Tartar).—72s. per cwt., less 2½% for ton lots.
 Potassium Citrate.—1s. 7d. to 1s. 10d. per lb.
 Potassium Ferricyanide.—1s. 9d. per lb. Quiet.
 Potassium Iodide.—16s. 8d. to 16s. 11d. per lb., according to quantity. Steady market.
 Potassium Metabisulphite.—6d. to 7½d. per lb., 1-cwt. kegs included, f.o.r. London.

Potassium Permanganate.—B.P. crystals, 7½d. per lb., spot.
 Quinine Sulphate.—2s. 3d. to 2s. 4d. per oz., in 100 oz. tins. Steady market.
 Resorcin.—3s. 9d. per lb. In fair quantities.
 Saccharin.—63s. per lb. in 50 lb. lots.
 Salol.—3s. 3d. per lb., for cwt. lots.
 Silver Proteinate.—12s. per lb. for satisfactory product light in colour.
 Sodium Benzoate, B.P.—1s. 10d. to 2s. 2d. per lb.
 Sodium Citrate, B.P.C., 1911.—1s. 4d. to 1s. 7d. per lb., according to quantity. U.S.P., 1s. 7d. to 1s. 10d. per lb.
 Sodium Hyposulphite, Photographic.—£14 to £15 per ton, according to quantity, d/d consignee's station in 1-cwt. kegs.
 Sodium Metabisulphite Crystals.—37s. 6d. to 60s. per cwt., net cash, according to quantity.
 Sodium Nitroprusside.—16s. per lb.
 Sodium Potassium Tartrate (Rochelle Salt).—75s. per cwt., for ton lots and upwards.
 Sodium Sulphate.—Powder, 1s. 10d. to 2s. 2d. per lb. Crystal, 2s. to 2s. 2d. per lb. Flake, 2s. 3d. to 2s. 4d. per lb.
 Sodium Sulphide, pure recrystallised.—10d. to 1s. 2d. per lb.
 Sodium Sulphite, anhydrous, £27 10s. to £28 per ton, according to quantity; 1-cwt. kegs included.
 Sulphonol.—12s. 8d. per lb.
 Thymol.—15s. per lb.

Perfumery Chemicals

Acetophenone.—9s. per lb.
 Aubepine (ex Anethol).—10s. per lb.
 Amyl Acetate.—3s. per lb.
 Amyl Butyrate.—6s. 6d. per lb.
 Amyl Salicylate.—3s. 1½d. per lb.
 Anethol (M.P. 21/22° C.).—5s. per lb.
 Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. 6d. per lb.
 Benzyl Alcohol free from Chlorine.—2s. 6d. per lb.
 Benzaldehyde free from Chlorine.—3s. per lb.
 Benzyl Benzoate.—2s. 9d. per lb.
 Cinnamic Aldehyde Natural.—15s. 6d. per lb.
 Coumarin.—14s. per lb.
 Citronellol.—10s. per lb.
 Citral.—8s. 6d. per lb.
 Ethyl Cinnamate.—9s. per lb.
 Ethyl Phthalate.—3s. per lb.
 Eugenol.—9s. 6d. per lb.
 Geraniol (Palmarosa).—28s. 6d. per lb.
 Geraniol.—8s. to 16s. per lb.
 Heliotropine.—6s. 3d. per lb.
 Iso Eugenol.—14s. 6d. per lb.
 Linalol ex Bois de Rose.—20s. per lb.
 Linalyl Acetate.—18s. 6d. per lb.
 Methyl Anthranilate.—9s. 3d. per lb.
 Methyl Benzoate.—5s. per lb.
 Musk Ambrette.—50s. per lb.
 Musk Ketone.—37s. 6d. per lb.
 Musk Xylol.—9s. 6d. per lb.
 Nerolin.—4s. 6d. per lb.
 Phenyl Ethyl Acetate.—15s. per lb.
 Phenyl Ethyl Alcohol.—13s. per lb.
 Rhodinol.—37s. 6d. per lb.
 Safrol.—1s. 8d. per lb.
 Terpineol.—1s. 10d. per lb.
 Vanillin.—21s. 6d. to 25s. per lb. Price reduced to meet continental competition.

Essential Oils

Almond Oil, Foreign S.P.A.—13s. 3d. per lb.
 Anise Oil.—3s. per lb.
 Bergamot Oil.—17s. per lb.
 Bourbon Geranium Oil.—18s. per lb.
 Camphor Oil.—60s. per cwt.
 Cananga Oil, Java.—11s. 3d. per lb.
 Cinnamon Oil, Leaf.—5½d. per oz.
 Cassia Oil, 80/85%.—9s. 3d. per lb.
 Citronella Oil.—Java, 85/90%, 4s. 6d. per lb. Ceylon, 2s. 10d. to 3s. per lb., according to quality.
 Clove Oil.—7s. per lb.
 Eucalyptus Oil, 70/75%.—2s. per lb.
 Lavender Oil.—French 38/40% Esters, 29s. 9d. per lb.
 Lemon Oil.—7s. per lb. Advanced again.
 Lemongrass Oil.—4s. 9d. per lb.
 Orange Oil, Sweet.—10s. 9d. per lb.
 Otto of Rose Oil.—Bulgarian, 45s. per oz. Anatolian, 26s. 6d. per oz.
 Palma Rosa Oil.—15s. 6d. per lb.
 Palma Rose Oil.—15s. 3d. per lb.
 Peppermint Oil.—Wayne County. No good quality material available. Japanese, 18s. per lb.
 Petitgrain Oil.—8s. 6d. per lb.
 Sandal Wood Oil.—Mysore, 26s. per lb. Australian, 18s. 6d. per lb.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to THE CHEMICAL AGE by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

Glasgow, July 24, 1925.

SINCE our last report, practically all local works have been on holiday, and consequently little business has been passing in the Scottish heavy chemical market. Prices are on about the same level as last reported.

Industrial Chemicals

ACID ACETIC.—In moderate request and price unchanged. 98/100% glacial, £56 to £67 per ton, according to quality and packing, c.i.f. U.K. ports; 80% pure, £40 to £42 per ton; 80% technical, £39 to £41 per ton, packed in casks, c.i.f. U.K. ports.

ACID BORIC.—Crystal, granulated or small flaked, £40 per ton; powdered, £42 per ton, packed in bags, carriage paid U.K. stations.

ACID CARBOLIC, ICE CRYSTALS.—Practically no demand. Nominally 4½d. per lb., but could probably be obtained for less.

ACID CITRIC, B.P. CRYSTALS.—In good demand, and price unchanged at about 1s. 4½d. per lb., less 5%, ex store. Offered for early delivery from continent at 1s. 4½d. per lb., less 5% ex wharf.

ACID FORMIC, 85%.—Offered for prompt shipment from the continent at about £47 per ton, c.i.f. U.K. ports. Spot material quoted £49 per ton, ex store.

ACID HYDROCHLORIC.—In little demand. Price 6s. 6d. per carboy, ex works.

ACID NITRIC 80°.—Usual steady demand quoted £23 15s. per ton, ex station, full truck loads.

ACID OXALIC, 98/100%.—Unchanged at 3½d. per lb., ex store, spot delivery. In moderate demand. Offered for early shipment at about 3½d. per lb., ex wharf.

ACID SULPHURIC.—144°, £3 12s. 6d. per ton; 168°, £7 per ton, ex works, full truck loads. Dearsenicated quality, 20s. per ton more.

ACID TARTARIC, B.P. CRYSTALS.—In moderate demand and price unchanged at about 1s. 1d. per lb., less 5%, ex store. Offered for prompt shipment at 1s. 0½d. per lb., less 5%, ex wharf.

ALUMINA SULPHATE, 17/18%, IRON FREE.—Spot lots quoted £6 10s. per ton, ex store. Offered for prompt shipment from the continent at about £6 5s. per ton, c.i.f. U.K. ports.

ALUM, LUMP POTASH.—Spot material quoted £9 7s. 6d. per ton, ex store. Offered for prompt shipment at about £8 5s. per ton, c.i.f. U.K. ports.

AMMONIA ANHYDROUS.—Quoted 1s. 4½d. per lb., ex station, prompt delivery. Containers extra and returnable.

AMMONIA CARBONATE.—Lump, £37 per ton; powdered, £39 per ton. Packed in 5 cwt. casks, delivered U.K. ports.

AMMONIA LIQUID, 88°.—In steady demand. Unchanged at 2½d. to 3d. per lb., delivered according to quantities.

AMMONIA MURIATE.—Grey galvaniser's crystals quoted £28 per ton, ex station. Offered from the continent at about £24 per ton, c.i.f. U.K. ports. Fine white crystals quoted £19 10s. per ton, c.i.f. U.K. ports.

GLAUBER SALTS.—English material unchanged at £4 per ton, ex store or station. Continental offered at about £3 per ton, c.i.f. U.K. ports.

LEAD, RED.—Continental material quoted £40 per ton, c.i.f. U.K. ports. Spot material available at about £42 per ton, ex store.

LEAD, WHITE.—Now quoted £43 per ton, ex store, spot delivery.

LEAD, ACETATE.—White crystals quoted £44 10s. per ton, spot delivery. Brown quality, £43 per ton, ex store. White crystals on offer from the continent at £43 15s. per ton, c.i.f. U.K. ports. Brown, about £38 per ton, c.i.f. U.K. ports.

LEAD, NITRATE.—In moderate demand. Quoted £42 per ton, ex station or f.o.b.

MAGNESITE, GROUND CALCINED.—Usual steady demand and price unchanged at about £8 per ton, ex station.

MAGNESIUM CHLORIDE.—Offered from the continent at £5 per ton, c.i.f. U.K. ports. Spot material still available at about the same figure, ex store.

POTASH CAUSTIC, 88/92%.—Offered for prompt shipment at about £28 5s. per ton, ex wharf. Spot material quoted at about £30 per ton, ex store.

POTASSIUM BICHROMATE.—Price for home consumption, 5d. per lb., delivered.

POTASSIUM CARBONATE, 96/98%.—Quoted £25 5s. per ton, c.i.f. U.K. ports. Spot material available at about £26 5s. per ton, ex store.

ARSENIC.—Refined white Cornish arsenic at about £25 per ton, ex wharf, early delivery. Spot lots quoted £26 per ton, ex store. Foreign arsenic quoted £23 5s. per ton, c.i.f. U.K. ports.

BARIUM CARBONATE 98/100%.—Offered from the continent at £7 15s. per ton c.i.f. U.K. ports, prompt shipment.

BARIUM CHLORIDE 98/100%.—Now quoted £10 per ton, ex store, for English material. Offered from the continent at about £8 5s. per ton, c.i.f. U.K. ports.

BLEACHING POWDER.—Spot lots quoted £10 10s. per ton, ex station. Contracts 20s. per ton less.

BARYTES.—English material unchanged at £5 5s. per ton, ex works. Continental quoted £50 per ton, c.i.f. U.K. ports.

BORAX.—Granulated £24 10s. per ton. Crystals £25 per ton. Powdered £26 per ton, carriage paid U.K. stations minimum ton lots.

CALCIUM CHLORIDE.—English material unchanged at £5 12s. 6d. to £5 17s. 6d. per ton, carriage paid U.K. stations. Continental on offer at about £3 12s. 6d. per ton, c.i.f. U.K. ports.

COPPERAS, GREEN.—Unchanged at about £3 5s. per ton, ex works, packed in casks free.

COPPER SULPHATE.—Quoted £23 per ton, ex store, spot delivery. English material for export about £24 10s. per ton, f.o.b. U.K. ports.

FORMALDEHYDE, 40%.—Quoted £39 10s. per ton, ex store, spot delivery. Offered for prompt shipment from the continent at about £38 15s. per ton, c.i.f. U.K. ports.

POTASSIUM CHLORATE.—Still scarce for early delivery. Some available at about 3½d. per lb., c.i.f. U.K. ports. Spot material quoted 4d. per lb., ex store.

POTASSIUM NITRATE, SALTPETRE.—90% refined granulated quoted at about £24 10s. per ton, c.i.f. U.K. ports. Spot material quoted £27 per ton, ex store.

POTASSIUM PERMANGANATE, B.P. CRYSTALS.—On offer at 7½d. per lb., ex store. Offered for prompt shipment from the continent at about 7½d. per lb., ex wharf.

POTASSIUM PRUSSIAN, YELLOW.—In little demand and price unchanged at about 7d. to 7½d. per lb., ex store.

SODA CAUSTIC.—76/77%, £18 per ton; 70/72%, £16 12s. 6d. per ton; broken, 60%, £17 2s. 6d. per ton; powdered, 98/99%, £21 7s. 6d. per ton. All carriage paid U.K. stations, spot delivery. Contracts 20s. per ton less.

SODIUM ACETATE.—Rather cheaper offers from the continent. Now quoted £17 10s. per ton, c.i.f. U.K. ports. Spot material available at about £20 per ton, ex store.

SODIUM BICARBONATE.—Refined recrystallised quality £10 10s. per ton, ex quay or station. M.W. quality, 30s. per ton less.

SODIUM CARBONATE.—Soda crystals, £5 to £5 5s. per ton, ex quay or station; powdered or pea quality, £1 7s. 6d. per ton more; alkali 58%, £8 12s. 3d. per ton, ex quay or station.

SODIUM HYPOSULPHITE.—English material quoted £9 10s. per ton, ex station. Pea crystals, £14 per ton, ex station. Continental on offer at about £9 5s. per ton, ex store.

SODIUM NITRATE.—Quoted £13 per ton, ex store. 96/98% refined quality, 7s. 6d. per ton extra.

SODIUM NITRATE 100%.—Quoted £24 per ton, ex store. Offered from the continent at about £22 5s. per ton, c.i.f. U.K. ports.

SODIUM PRUSSIAN, YELLOW.—Nominally 4d. per lb., ex store, but in little demand and could be obtained for less probably.

SODIUM SULPHATE, SALTCAKE.—Price for home consumption £3 10s. per ton f.o.r. works. Good inquiry for export and higher prices obtainable.

SODIUM SULPHIDE.—English material: solid, 60/62, now £13 per ton; broken £14 per ton; flake, £15 per ton; crystal £8 10s. per ton, carriage paid U.K. stations, minimum four-ton lots, with slight reductions for contracts to the end of the year. 60/62% solid offered from the continent at £10 15s. per ton c.i.f. U.K. ports; broken £1 per ton more. 30/32% crystals, £7 15s. per ton, c.i.f. U.K. ports.

SULPHUR.—Much higher quotations from Sicilian exporters. Prices for spot delivery nominally, flowers, £10 10s.; roll, £9 10s.; rock, £9 7s. 6d.; ground, £9 10s., ex store, spot delivery.

ZINC CHLORIDE 100%.—Quoted from the continent at £24 5s. per ton, c.i.f. U.K. ports. 97/98% of English manufacture on offer at £25 per ton, f.o.b. U.K. ports.

ZINC SULPHATE.—Commercial crystals on offer from the continent at about £12 per ton, c.i.f. U.K. ports.

NOTE.—The above prices are for bulk business and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

MONO ETHYL ANILINE.—Small home inquiries, 5s. 10d. per lb.

ALPHA NAPHTHYLAMINE.—Fair home inquiries, 1s. 3d. to 1s. 4d. per lb.

BENZIDINE BASE.—Small home inquiries, 3s. 6d. per lb.

H. ACID.—Small home inquiries, 3s. 6d. per lb.

METANITRANILINE.—Small home inquiries, 3s. 11d. per lb.

DIPHENYLAMINE.—Small home inquiries, 2s. 10d. per lb.

Manchester Chemical Market

[FROM OUR OWN CORRESPONDENT.]

Manchester, July 24, 1925.

THE fact that we are now pretty well at the height of the holiday season does not make for active conditions in the chemical or any other market. For this reason, and, of course, for the more important reason that the industries which normally consume heavy chemicals in big bulk are anything but busy, the volume of trade on the Manchester market is relatively small. This applies both to home trade and to export business. Price changes since last report have not been very numerous, but the easy tendency in respect of one or two lines recorded last week continues.

Heavy Chemicals

The demand for bleaching powder is only moderate, though values are fairly steady at £9 10s. per ton. Prussiate of soda is rather quiet at round 4d. per lb. Alkali is firm and in quietly steady request at £6 15s. per ton. A fair business is being done in caustic soda; prices range from £15 12s. 6d. per ton for 60 per cent. strength to £18 for 76-77 per cent. Sodium sulphide is attracting a limited amount of attention at £12 15s. per ton for 60-65 per cent. concentrated solid and £9 to £9 5s. for commercial material. Hyposulphite of soda is moderately active and prices are maintained at about £14 per ton for photographic crystals and £9 5s. for commercial. Chlorate of soda is in small demand at the recent level of 2½d. to 3d. per lb. Saltcake is on offer at £3 10s. to £3 12s. 6d. per ton, but business in this material is restricted. Glauber salts are quiet but unchanged at round £3 12s. 6d. per ton. Acetate of soda is rather dull at about £18 per ton. Soda crystals are steady at £5 5s. per ton, and a fair volume of business is being put through. Bicarbonate of soda is also maintained at £10 10s. per ton, but the demand is slow. Phosphate of soda is still quiet and easy at about £12 10s. per ton.

Among potash compounds, caustic is quoted at round £29 per ton and carbonate at £24 10s., with demand in both cases on rather quiet lines. Prussiate of potash is steady and in moderate inquiry at about 7d. per lb. Chlorate of potash is unchanged either in position or value at 3½d. per lb. Permanganate of potash is offering at 6d. to 6½d. per lb. for commercial and 7½d. for B.P. quality. Bichromate of potash is selling slowly, but values are unchanged at round 5d. per lb.

Business in arsenic continues very slow and prices are weak, white powdered Cornish makes being quoted here at about £25 per ton. Sulphate of copper is quiet but fairly steady at about £24 5s. per ton. Nitrate of lead hovers between £40 and £41 per ton, but the demand for this material is inactive. Acetate of lead is attracting a small amount of attention at round £40 per ton for white and £40 for brown. Acetate of lime is still on offer at £14 5s. per ton for grey and £8 for brown. Commercial Epsom salts are selling slowly at £4 5s. per ton, with magnesium sulphate, pharmaceutical quality, unchanged at about £6.

Acids and Tar Products

The demand for acetic acid is not very pressing, but prices are steadier at £38 per ton for 80 per cent. commercial and £67 for glacial. Oxalic acid is dull at 3½d. per lb. Citric acid meets with a quietly steady inquiry, and values are firm at 1s. 4½d. per lb. Tartaric acid is also maintained at round 1s. per lb.

The nominal quotation of 40s. per ton for pitch still holds good; business is of small dimensions, though inquiry for next shipping season is reported. Solvent naphtha is steady at about 1s. 5½d. per gallon. Creosote oil is quiet and unchanged at about 6d. per gallon. Carbolic acid is still featureless at 4½d. per lb. for crystals and nominally 1s. 6d. per gallon for crude. Naphthalene is quiet at £4 and upwards for crude and £12 10s. to £13 per ton for refined material.

American Market Movements

(From Drug and Chemical Markets.)

INDUSTRIAL chemical prices show but little change, and factors a steady consuming demand for the entire list. Arsenic remains weak and stocks remain large.

Benzene in very heavy demand in all quarters and prices remain firm. Other light oils steady. Pyridine very strong at higher prices. Naphthalene very strong at higher prices.

Naphthalene, cresylic acid, and phenol quiet but firm. Intermediate prices show no change.

Fine chemicals show fair activity with demand concentrated on seasonal items. Bismuth salts have all been advanced owing to increased cost of metal. Benzoic acid and sodium benzoate have been slashed in competition. Menthol much firmer.

Linseed oil drops sharply on poor demand and heavy resale. Chinawood oil steady at unchanged prices. Animal oils continue in strong position.

Transport of Dangerous Chemicals

Amended Railway Regulations

IN consequence of representations made by members of the chemical industry regarding the present requirements of the railway companies with respect to the branding or marking of packages containing Dangerous, Corrosive, and Poisonous Chemicals for conveyance by Merchandise Trains, the whole of the Regulations relating to such chemicals shown on pages 396 to 450 of the General Railway Classification of Goods, dated April 1, 1924, have been revised for operation as from July 1, 1925.

It will be seen that, in lieu of being branded or marked as at present, packages containing Dangerous, Corrosive, and Poisonous Chemicals (with certain exceptions) must bear distinctive loading labels. These labels have been adopted with the object of securing the safe handling and expeditious transit of consignments, and the traders concerned are asked to make the necessary arrangements for the Revised Regulations to be observed as from the date named. Copies of the regulations are obtainable from the Secretary, Railway Clearing House, 123, Seymour Street, London, N.W.1.

British Oxygen Prospects

MR. K. S. MURRAY, chairman of the British Oxygen Co., Ltd., speaking at the general meeting in London last week, said that, all circumstances considered, their progress might be regarded as satisfactory. With reference to the future prospects of the company, their prosperity was so much wrapped up with that of the country's staple engineering trades that, until a marked revival in the latter took place, the company could not hope for much, if any, improvement in its own affairs. The company had not only increased the number of oxygen factories, but had reconstructed and modernised all the plants in their main factories. In practically every industrial centre the company was to-day equipped with new and improved oxygen-producing plants, for the most part manufactured by themselves in their engineering works at Edmonton, and the geographical situation of each factory, as well as its capacity, was based on their knowledge of local requirements in times of prosperity, so that everywhere they were in a position to supply in large quantities cheaper and better oxygen than before.

Mr. Murray referred to certain experiments which had been carried out during the year, with a view to increasing still further the efficiency of their oxygen plants, and stated that after prolonged trials on a practical scale in one of the company's factories, as a result of those experiments they had now decided to effect the same modification on all other existing oxygen plants and to adopt it in all new ones. The improvement resulted in quite an appreciable increase in output without additional power, and they had fully protected the alteration.

Crossley Heavy-Oil Engines

Two publications describing their heavy-oil engines have been issued by Crossley Brothers, Ltd., Openshaw, Manchester, in which detailed reports of tests carried out on their engines and of their latest "Crossley-Premier" model are given. Engines at the Woodmansterne Pumping Station of the Sutton District Water Co., Chipstead, Surrey, were recently tested to determine the amount of fuel oil consumed in comparison with the volume and pressure of water pumped. One of these engines was coupled to a pump delivering 1,000 gallons of water per minute against 388 ft. maximum head, and was reported as giving satisfactory results over the period of the test, eleven hours, and both engines entirely fulfilled their specified requirements. The "Crossley-Premier" heavy-oil engine is of the cold-starting, solid injection type and is made in units up to 1,000 b.h.p. continuous working load.

Company News

INTERNATIONAL NICKEL CO.—A quarterly dividend of $1\frac{1}{2}$ per cent. on the preferred stock has been declared, payable on August 1.

VENO DRUG CO.—The directors have declared dividends of 9d. per share and 1s. 2d. per share respectively on the 8 per cent. preference and the 12 per cent. preferred ordinary shares.

INTERNATIONAL PAINT AND COMPOSITIONS CO., LTD.—The directors announce that dividends in future will be payable on March 31 and September 30 in each year, instead of February 28 and August 31, as heretofore.

CELLULOSE HOLDINGS AND INVESTMENT CO.—The extra interest payable to the debenture stockholders in respect of their participation in profits for the half-year ending June 30, 1925, is at the rate of £1 4s. 8d. per cent., free of tax, payable on August 1.

ENGLISH CROWN SPELTER CO., LTD.—It is announced that the balance of 10s. per share on the recent issue of 100,000 shares of £1, which were offered to shareholders credited 10s. paid out of the reserve funds, is payable in four instalments of 2s. 6d. per share on acceptance (on or before August 1), September 15, October 31, and December 1 respectively.

BURT, BOULTON AND HAYWOOD, LTD.—A statement, for information only, was published on Thursday respecting the capital of the company, which has been increased to £620,000 by the creation of 120,000 new 7 per cent. cumulative second preference shares of £1 each, and reorganised so as to consist of 150,000 7 per cent. cumulative preference shares of £1 each and 470,000 ordinary shares of £1 each.

NATIONAL SMELTING CO., LTD.—The directors in their report for the year to December 31, 1924, state that the profit on trading, dividends and interest on investments, after providing for depreciation, income tax, corporation profits tax and reserve for contingencies, amount to £192,295. The net profit, after payment of all expenses, amounts to £65,986, out of which the dividend on the preference shares to December 31 last has been paid, leaving a balance to be carried forward of £23,389.

SYNTHETIC AMMONIA AND NITRATES, LTD.—A trust deed dated June 24, 1925, to secure £2,000,000 debenture stock, has been registered constituting a specific charge on freehold hereditaments in Billingham, Durham, with buildings, fixed plant and machinery thereon, all lands and hereditaments in England and elsewhere, and all rights in respect thereof, and all immovable property which the company shall at any time be entitled to, moneys referred to in a guarantee agreement (including the whole cash proceeds of the stock), and all investments of such moneys and the income thereof, and a floating charge on the company's undertaking and property, present and future, including uncalled capital. The trustees are the Debenture Corporation, Ltd., Worcester House, Walbrook, London.

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

COOKING OILS.—A firm of manufacturers' agents in Trinidad desire to represent on a commission basis British suppliers of soya bean and other cooking oils. (Reference No. 100.)

CENTRIFUGAL PUMPS.—The Mechanical Department, Ministry of Public Works, Cairo, is inviting tenders for the supply, delivery, and erection of two centrifugal pumps and two 80 h.p. steam engines. Particulars on application to the D.O.T. (Reference A.X. 2222.)

PARAFFIN WAX.—A British commission agent of Santiago wishes to represent a British manufacturer or refiner of paraffin wax. (Reference No. 120.)

PINE GREASE.—A British commission agent of Santiago wishes to represent a British manufacturer of pine grease for lubricating wagon axles. (Reference No. 121.)

DYEING PLANT.—The Prisons Department of the Ministry of the Interior, Cairo, is calling for tenders, by August 18, for dyeing plant, accessories, and cost of erection. (Reference A.X. 2136.)

Tariff Changes

BRITISH INDIA.—The Government cannot consider the application for protection from the magnesium chloride industry.

SIERRA LEONE.—An order prohibits, as from July 1, 1925, the importation of methylated spirits into the colony, except (a) mineralised methylated spirits mixed as follows:—To every 90 parts by volume of spirits $9\frac{1}{2}$ parts by volume of wood naphtha and $\frac{1}{2}$ of one part of crude pyridine, and to every 100 gallons of the mixture $\frac{3}{4}$ of one gallon of mineral naphtha or petroleum oil and not less than $\frac{1}{10}$ of an ounce by weight of powdered aniline dye (methyl violet); and (b) in cases in which a licence issued by the Governor authorising importation has been first obtained, industrial methylated spirits mixed as follows:—To every 95 parts by volume of spirits 5 parts by volume of wood naphtha, and also $\frac{1}{2}$ of one part of crude pyridine to every 100 parts of the volume of the mixture.

AUSTRIA.—An order amends the import duties on Thomas slag and calcium cyanamide. Details only from the D.O.T.

HUNGARY.—A Decree of June 30 provides that the reduced duties of 6.20 gold korona per 100 kilogs. on mineral oils falling under Tariff Nos. 322 (a) 2 and 322 (b) and 6.80 gold korona per 100 kilogs. on mineral oils falling under Tariff No. 322 (c) are to continue to be applied until August 31. A further Decree of June 30 provides that these duties are to be levied on net weight. On and after September 1 the above rates will be increased to 8 and 9 gold korona respectively per 100 kilogs., i.e., to the rates prescribed by the Customs Tariff.

New Chemical Trade Marks

Applications for Registration

This list has been specially compiled for us by Mr. H. T. P. Gee, Patent and Trade Mark Agent, of Staple House, 51 and 52, Chancery Lane, London, W.C.2, from whom further information may be obtained, and to whom we have arranged to refer any inquiries relating to Patents, Trade Marks and Designs.

Opposition to the Registration of the following Trade Marks can be lodged up to August 22, 1925.

"DURASHEEN."

456,081. For lacquers. Thomas Howard Bond, 30, Chiswell House, Finsbury Pavement, London, E.C.2; manufacturer. February 9, 1925.

"LOVAR."

459,549. For enamels, varnishes, paints, dry colours, distempers, japans, lacquers and anti-corrosive oils. Class 1. The London Varnish and Enamel Co., Ltd., City Works, Carpenter's Road, Stratford, London, E.15; varnish and japan manufacturers. June 9, 1925. (To be Associated. Sect. 24.)

"BOROCAINE."

459,625. For chemical substances prepared for use in medicine and pharmacy. The British Drug Houses, Ltd., 22 to 30, Graham Street, City Road, London, N.1; wholesale druggists. June 11, 1925.

Australian and African Markets

DETAILED statistics of Australia's imports for 1923-24 are now available, and the figures suggest that competition from other countries is likely to be a serious menace if British exporters are not fully alive to the situation in the future.

There is a decline of over $4\frac{1}{2}$ million £ in United Kingdom imports and a decline also in the percentage of British goods in competitive imports, according to the *Manchester Guardian Commercial*. France is increasing her silk supplies, and the U.S.A. has placed increased quantities of dyed goods.

South Africa has been increasing her imports. Minerals, earthenware, and glassware are up, and stand at £100,590 for 1924. Oils, resins, waxes, paints, and varnish at £276,428 also showed an increase, and drugs, chemicals, and fertilisers rose to £144,874.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

County Court Judgments

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

LAMBERT (SAMUEL) AND CO., LTD., 10, Great St. Helens, E.C., chemical merchants. (C.C., 25/7/25.) £11 3s. 4d. March 18th.

PILLING, Roland, 159, Union Road, Oswaldtwistle, chemical plumber. (C.C., 25/7/25.) £52 19s. 1d. June 19th.

RIDLEY, James Farage, Scholars Green, chemical manufacturer. (C.C., 25/7/25.) £14 os. 11d. May 26th.

Mortgages and Charges

[NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]

BEKRITE, LTD., Hayes, varnish manufacturers. (M., 25/7/25.) Registered July 8, £6,000 (not ex.) charge, to A. F. Barry, 50, Oxford Street, and another; general charge. *£2,700. January 1, 1925.

MATTHEWS LABORATORIES, LTD., Bristol. (M., 25/7/25.) Registered July 8, mortgage, to Bank; charged on property at Hensman Hill, Clifton. *Nil. March 6, 1925.

London Gazette, &c.

Companies Winding Up Voluntarily

AIN ZEFT OIL CO., LTD. (C.W.U.V., 25/7/25.) By special resolution, June 22, confirmed July 14, A. S. Browns, 53, Parliament Street, Westminster, S.W.1, appointed liquidator.

ANGLO AUSTRIAN MAGNESITE CO., LTD. (C.W.U.V., 25/7/25.) By special resolution, June 16, confirmed July 1, B. C. Davies, 6, East Parade, Sheffield, chartered accountant, appointed liquidator.

HOLDERS LONDON (1925), LTD. (C.W.U.V., 25/7/25.) W. S. Evans, 12, Grosvenor Gardens, Westminster, chartered accountant, appointed liquidator, July 7.

Bankruptcy Information

BOWEN, Evan Morgan, Penhydd, Blundell Avenue, Porthcawl, Glamorgan, chemical engineer. First meeting, July 31, 2.30 p.m., 34, Park Place, Cardiff. Public examination, August 21, 10 a.m., County Court, Wyndham Street, Bridgend.

Partnership Dissolved

TURNER (R. B.) AND CO. (Minnie TURNER, Frederick SMITH and Charles William TURNER), chemical and surgical glassware manufacturers and merchants, 9, 10 and 11, Eagle Street, Holborn, W.C.1, by mutual consent as from June 30, 1925, so far as regards F. Smith. Debts received and paid by M. Turner and C. W. Turner, who will continue the business.

Receivership

SOLOMIA (1922), LTD. (R., 25/7/25.) J. H. Reed, of 84, Waterford Road, S.W.6, was appointed receiver on July 2, 1925, under powers contained in debenture dated September 17, 1924.

New Companies Registered

J. C. COWLISHAW, LTD. Manufacturers of glass apparatus and thermometers, quartz apparatus, mercury pumps, etc. Nominal capital, £1,500 in £1 shares. A director: J. C. Cowlshaw, 403, Chester Road, Manchester.

MULTAR SYNDICATE, LTD., 46, Cannon Street, London, E.C. To acquire and develop and turn to account a patent and trade mark for the British Isles for the emulsification of bitumen and coal tar, etc. Nominal capital, £6,000 in £1 shares.

STANDARD OZONE CO., LTD. Manufacturers of and dealers in appliances and processes for medical, surgical, chemical, scientific or other purposes, etc. Nominal capital, £12,000 in £1 shares. Solicitors: Bede & Co., 16, Great George Street, London, S.W.1.

STANDARD SOAP CO., LTD., 1, Balham Road, Edmonton. Soap manufacturers, refiners and preparers of and dealers in oils and oleaginous and saponaceous substances, etc. Nominal capital, £10,000 in £1 shares.

WHITE SEAL SOAP CO., LTD., Sentinel House, Southampton Row, London, W.C.1. Soap makers, chemists, chemical manufacturers, etc. Nominal capital, £5,500 in 5,000 10 per cent. cumulative preference shares of £1 and 10,000 ordinary shares of 1s.

Latest Government Contracts

The following contracts have been placed recently by the various Government departments:

Admiralty

CIVIL ENGINEER-IN-CHIEF'S DEPARTMENT.—Portland Cement: Smeed, Dean and Co., Ltd., Sittingbourne, Kent; T. Beynon and Co., Ltd., London, E.C.; Cement Marketing Co., Ltd., London, S.W.

CONTRACT AND PURCHASE DEPARTMENT.—X-ray Apparatus: A. E. Dean, London, E.C.; Newton and Wright, Ltd., London, N.

War Office

Activated Charcoal: Sutcliffe, Speakman and Co., Ltd., Leigh. Augers, Earth Boring: C. Nurse and Co., London, S.E. Boiler: Riley Bros. (Boilermakers), Ltd., Stockton. Linseed Oil, Boiled: Langley, Smith and Co., London, E. Paint, Ground in Oil: Cookson, Lead and Antimony Co., Ltd., Newcastle-on-Tyne; Rowe Bros. and Co. (Bootle), Ltd., Liverpool. Stannic Chloride: W. Gregory, Greenwich. Zinc: H. Gardner and Co., Ltd., London, E.C.; The British Metal Corporation, Ltd., London, E.C.

Air Ministry

Cement (Iraq): Cement Marketing Co., Ltd., London, S.W. Sewage Compressors, etc. (Tangmere): Adamson and Co., Dukinfield. Extinguishers, Fire: General Fire Appliances Co., London, E.C. Plates, Panchromatic: Ilford, Ltd., Ilford. Plates, Photographic: Elliott and Sons, Ltd., Barnet. Radium Compound: F. Harrison Glew, London, S.W. Refills, Tetrachloride: Pyrene Co., Ltd., London, S.W. Soda, Caustic: Chance and Hunt, London, E.C.; Brunner, Mond and Co., Ltd., London, W.; United Alkali Co., Ltd., London, E.C. Varnish: Gross, Sherwood and Heald, Ltd., London, E.

H.M. Office of Works

Asphalte: The Penmaenmawr and Trinidad Lake Asphalte Co., Ltd., Liverpool; Lawford and Co., London, E. Asphalter: Engert and Rolfe, Ltd., London, E. Fire Extinguishers and Charges: Bert Birks and Co., Cradley Heath; Mather and Platt, Ltd., London, S.W.; Moneys Patents, Ltd., London, E. Laboratory Fittings, etc.: Brown and Son (Alembic Works), Ltd., London, N. Soap: The Hull Chemical Works Co., Hull; M. P. Hunt, London, E.; John Knight, Ltd., London, E.; Joseph Watson and Sons, Ltd., Leeds. Tallow: John Knight, Ltd., London, E.

Crown Agents for the Colonies

Asbestos Corrugated Sheet: Bell's Poilite and Everite Co., Ltd., London, S.E. Cement: Cement Marketing Co., London, S.W. Concrete Mixers: Ransome Machinery Co. (1920), Ltd., London, S.W. Engines, Oil, etc.: Campbell Gas Engine Co., Ltd., Halifax, Yorks. Gelignite, etc.: Nobel's Industries, London, S.W. Machine Boiler, Spraying and Gritting: W. Weeks and Son, Ltd., Maidstone. Machines, Concrete, Block: W. Winget, Ltd. (1924), London, S.W. Novarsenobillon: May and Baker, Ltd., London, S.W. Oil: Wakefield and Co., London, E.C. Paint: Wilkinson, Heywood and Clark, London, W.C.; Red Hand Composition, London, E.C.; Torbay Paint Co., Ltd., London, E.C. Petrol: F. and A. Swanzy, Ltd., London, W.C. Quinine: Howards and Sons, Ltd., Ilford, Essex. Tar and Tar Coal: Gas Light and Coke Co., London, E.C. X-ray Apparatus: Watson and Sons, Ltd., London, W.C.

